The Electrical Industry's Weekly Magazine

May 9, 1960

Electrical World

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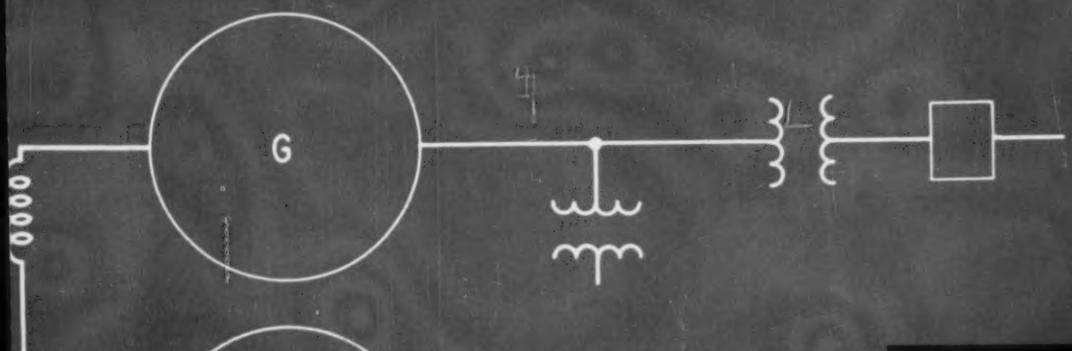
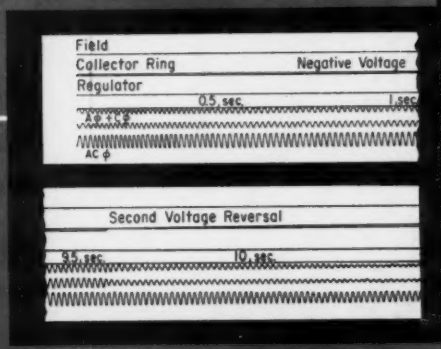


Study Shows Need for
Improved Generation Protection

...page 51



In Philadelphia Substation
Diesel Generators Shave Peaks

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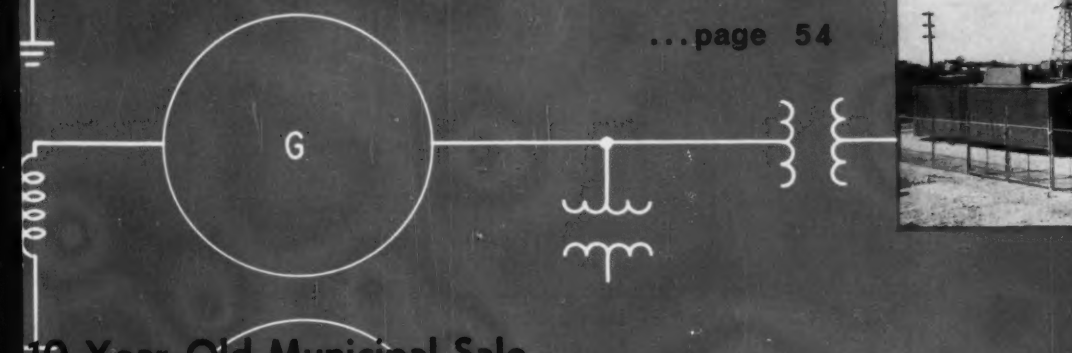

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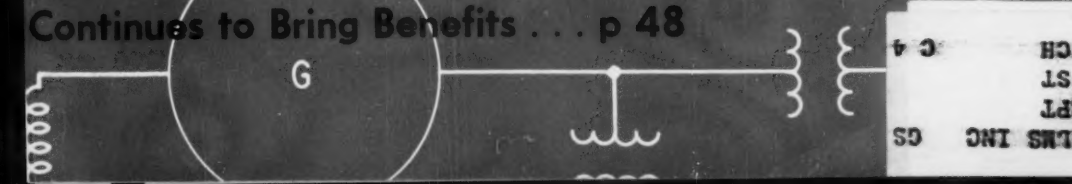

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ALLIS-CHALMERS

"Originators of 5/8% Step Regulators"

Caliband is an Allis-Chalmers trademark.

Lower! Lighter! Perfect for joint-pole use

new JFR regulators cut installation costs

CALIBAND control slashes setting time without changing customer voltage or interrupting service! A twist of the knob and you set or test voltage level and band width No need to return compensator settings to zero.

Allis-Chalmers all-new JFR is the top qualifier for joint-pole use . . . pad or platform mounting. Tank size and weight reduced up to 33%, due to JFR's improved materials and design techniques. Naturally, you save on transportation, handling and installation.

More new JFR advantages! Now offered as *standard*, position indicator drag hands reset by pushbutton on the control panel. A new, quick-sight gauge instantly reveals oil level. Exclusive unidirectional breather removes all moisture and contaminating gases. And a new cover, with hidden bushing mounting studs, cuts maintenance. *For all the facts ask your nearby A-C office for new JFR Bulletin 21B7977E or write* **Allis-Chalmers,** *Power Equipment Division, Milwaukee 1, Wisconsin.* A-1261

Electrical World

Vol. 153, No. 19 MAY 9, 1960

Published for 86 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

In This Week's Issue

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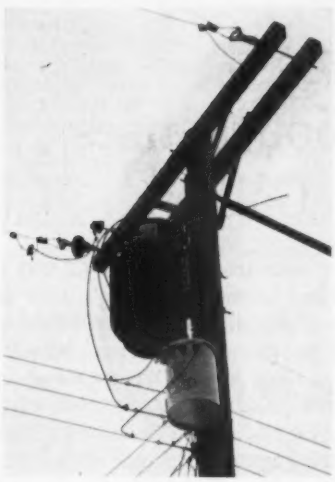

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American Public Power Association holds 17th annual meeting at Washington—some meeting highlights.....p 44

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Only 0.85% of total starts putter out or fail to come up to speed in more than a year's operation.....p 54

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INSTALLING OKOLITE-OKOPRENE POWER AND CONTROL CABLES NEAR THE TOP OF THE POWERHOUSE ACCESS SHAFT. Note the simplicity of the Loxarmor installation. Cables are fully protected against mechanical damage, yet easy to install. Plenty of room for additional lines if required here in the U.S.A.'s first large-scale underground generating plant.

Cable'bility at work

Underground powerhouse uses Okolite-Okoprene Cables

Cable'bility (cā'ble·bil'·i·ty) *new word. Noun.* **1.** Ability to design and manufacture electrical cables that give outstanding performance. **2.** Having long background and wide experience in cable research and application. **3.** Possessing keen understanding of customers' problems. Implies eagerness to serve faithfully and dedication to progress. **Syn.** The Okonite Company.

Two-thousand feet inside a granite mountain in California, 500 feet below the surface, are the generators of the new Haas Powerhouse that contribute 128,000 kilowatts to Pacific Gas and Electric's big King's River development.

Leading straight up the 480-foot elevator shaft above the generator room, through the rock to the switchyard atop the mountain ridge, are 10 Okolite-Okoprene Loxarmor-protected cables which handle switchyard control and auxiliary power circuits. Interlocked armor construction provides permanent mechanical protection without the difficult installation problems of conduit and the higher cost of either conduit or "bore hole" suspension.

Installations where both economy and reliability are important prove the benefits—to you—of service-proved Okonite cables. The Okonite Company, Subsidiary of Kennecott Copper Corporation, Passaic, N. J.

***where there's electrical power . . . there's* OKONITE CABLE**

E 41 A

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LETTERS

Electric Heat Not 'Premium Cost'

To the Editor:

One of your sister magazines last month published a special report titled "A Manual of Electric Space Heating 1960."

It appears to be an excellent professorial dissertation on many important theoretical, and some practical aspects of the subject. However, if we were still following some of the ideas expounded we would now be, or should be, out of business.

Watts loss remains a piece of secondary data and provides no fundamental tools with which to think through a new or modified situation.

The article appeared to dwell too heavily on rating existing heat loss situations without adequate regard for their being extremely impractical for satisfactory performance.

We emphatically deny the necessity of electricity for home heating being described as a premium cost item. Properly and effectively harnessed, we find that the costs of heating electrically at prevailing 1.5¢ rates can always be less than the costs involved with almost all automatic flame heating systems. To accomplish these results, moisture vapor and wind pressure problems in the insulation must be recognized and controlled much more effectively than described in the recent report.

Field performance uniformly obtained under a heat factor of .20 kwhr per degree day per 1,000 cubic ft, created by capable and financially sound dealers, will induce automatic growth of proper electric home heatings.

Clement L. Stanford
Electriliving Corp
Indianapolis 5, Ind.

▶ Reader Stanford heads a firm which fabricates electric heating units and installs them for home use.

Hole Digger in New Zealand

To the Editor:

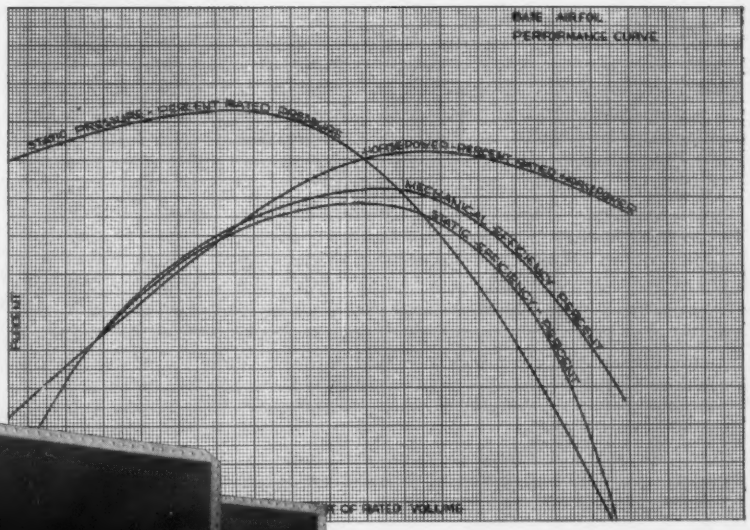
This board has for a number of years used power operated pole hole diggers . . . in connection with the erection of electric power distribution poles. Ours is a self contained unit complete with Diesel engine and is suspended from the shear legs or derrick on the truck by a wire rope attached to the Tulsa winch which is driven by a power take-off from the 5-ton petrol truck engine.

We have had two accidents to operating staff with this equipment. . . .

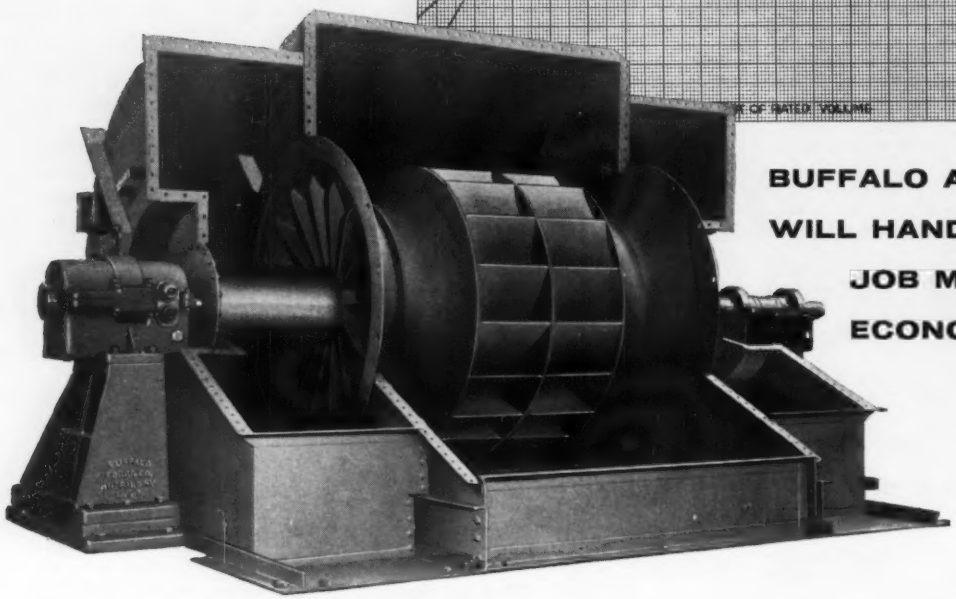
We would like to know whether this general type of pole hole digger is extensively used in the United States or whether supply authorities prefer diggers

(*Continued on page* 99)

PLAN TO OPERATE AT FULL RATED CAPACITY OVER EXTENDED PERIODS?



Performance curve of a Buffalo type "BA" Airfoil Fan shows how static efficiency curve peaks in the designed operating range of the capacity—pressure curve.



BUFFALO AIRFOILS WILL HANDLE THE JOB MOST ECONOMICALLY

Extreme high efficiency between 85 and 110% of rated volume — top performance against high static pressures — make the Buffalo Type "BA" Airfoil your best selection for continuous, full-capacity draft service. Its streamlined inlet bell and matching wheel flange form a smooth, path for easiest air flow into the wheel. Its aerodynamically formed airfoil blade channels provide optimum air passage thru the wheel; while the unique design diverging outlet permits best static regain from cutoff.

And the Type "BA" Airfoil is one of a full line of Mechanical Draft Fans to fit today's widely varying requirements — each built to the famous "Q" Factor* of excellence. For full details on the best draft fan for your money and your job, write for Bulletin FD-905.

**The "Q" Factor—the built-in Quality which provides trouble-free satisfaction and long life.*

BUFFALO FORGE COMPANY
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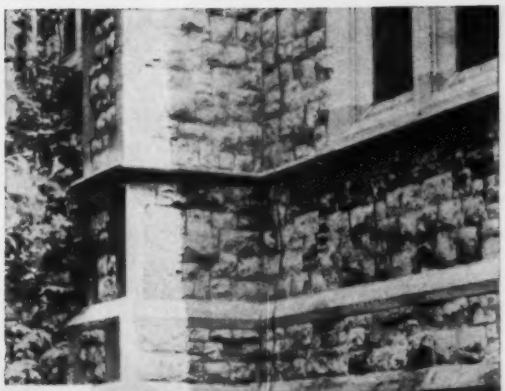
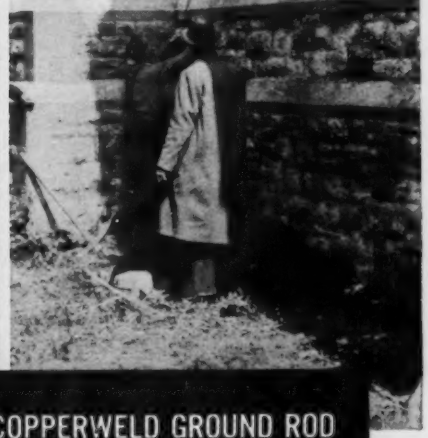
VENTILATING • AIR CLEANING • AIR TEMPERING • INDUCED DRAFT • EXHAUSTING • FORCED DRAFT • COOLING • HEATING • PRESSURE BLOWING

Dug up in an old English churchyard after 25 years' service





—COPPERWELD GROUND ROD still good for many more years of use

Copperweld Ground Rods never die—they don't even fade away. They go right on protecting your overhead lines and equipment, year after year, after year.

A company in England, specializing in lightning protection, recently exhumed a Copperweld Ground Rod put into service in 1935 to protect St. Matthews Church near London. When originally installed, this $\frac{5}{8}$" x 8-foot rod had a resistance reading of 10 ohms—and when dug up and examined, the rod was in perfect physical condition—ready for many more years of use.

For dependable, long-lasting grounds use Copperweld—the only ground rods with a thick copper covering inseparably molten-welded to a strong steel core. They provide stiffness for easy driving and rust resistance for long life. Copper-to-copper contacts throughout assure low resistance. For your protection, each rod is stamped "Copperweld."

COPPERWELD STEEL COMPANY

WIRE AND CABLE DIVISION *Glassport, Pa.*

For Export: COPPERWELD STEEL INTERNATIONAL COMPANY, N.Y.

Copperweld®

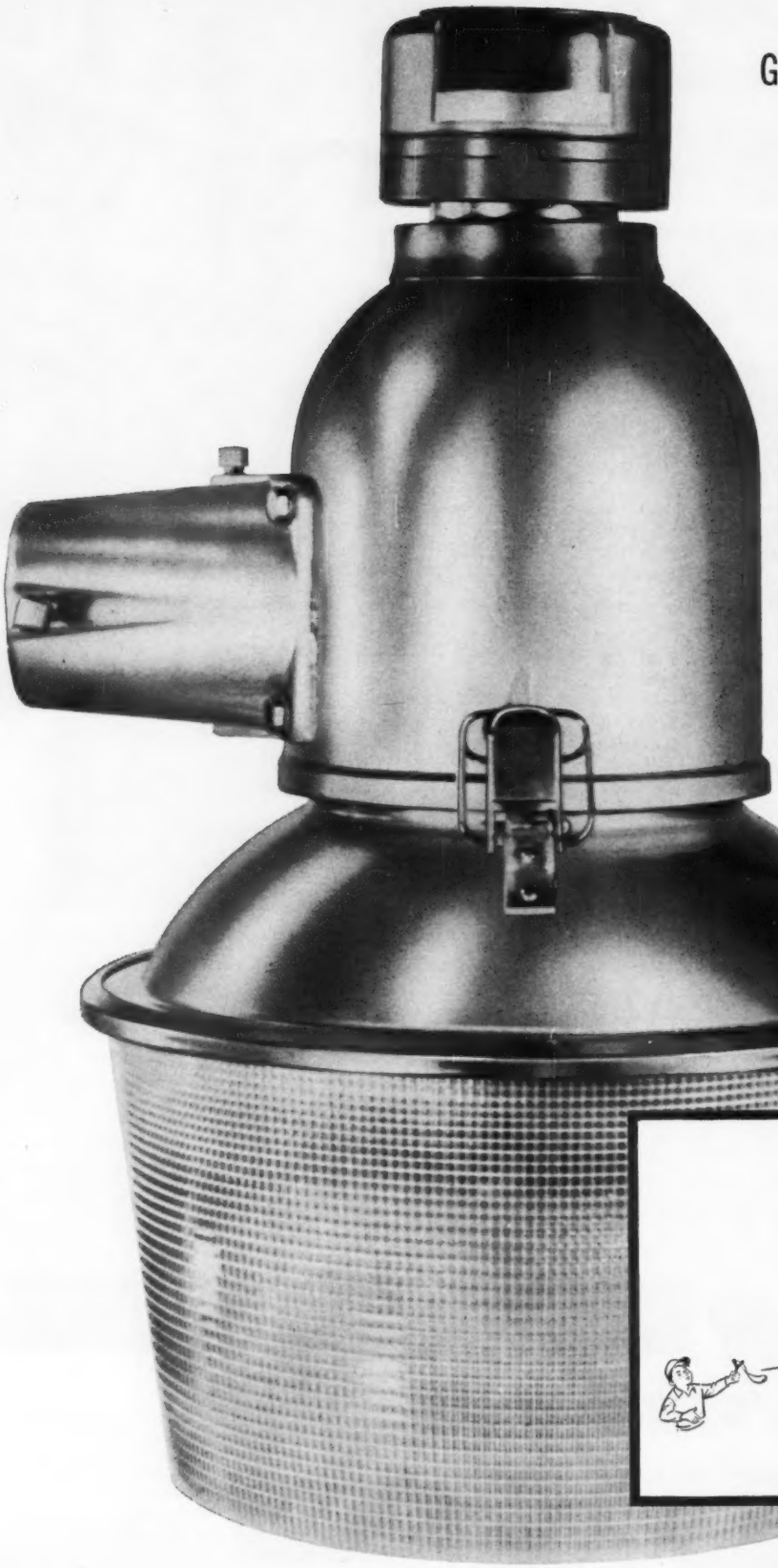
ground rods

the only ground rods with the **Molten-Weld**

This microphotograph of the Molten-Weld shows how the grains of copper and steel interlock to form a permanent, continuous weld.

GENERAL ELECTRIC'S

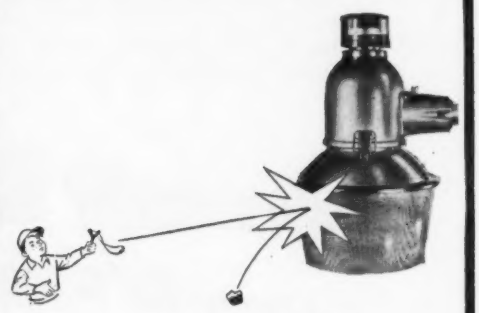
Boosts by



"PRIVATE-LIGHTING" PACKAGES Especially for "private-lighting" applications, General Electric offers the Acrylic-Suburban luminaire in attractively priced equipment packages:

Cat. No. C648G017– Acrylic - Suburban luminaire complete with cadmium-sulphide photoelectric control, acrylic refractor, hood with 175-watt built-in ballast (lamp not included), 4-foot aluminum bracket.

Cat. No. C648G016– Acrylic - Suburban luminaire complete with cadmium-sulphide photoelectric control, acrylic refractor, hood for up to 6000-lumen filament lamp, mogul base, 7-inch light center (lamp not included), 4-foot aluminum bracket.



BB's and stones bounce off

NEW ACRYLIC-SUBURBAN LUMINAIRE

"private-lighting" profits cutting maintenance costs

Exclusive shatter-resistant plastic refractor tops money-saving features

Here's a luminaire designed and built to keep your maintenance trucks in the garage, and your "private-lighting" accounts on the profit side of the ledger. It's the new General Electric Acrylic-Suburban.

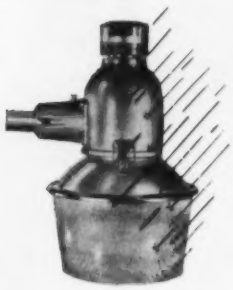
Realizing that repeated service calls can severely hamper any rural and suburban lighting program, General Electric has built into the Acrylic-Suburban these time- and money-saving features:

- The industry's first-and-only open refractor of durable plastic—virtually unbreakable in normal service—developed from General Electric's years of experience with acrylic refractors for mercury luminaires such as the M-250. This precision-molded refractor is more costly to make than glass and offers more resistance to all causes of breakage, yet you pay *no premium* in price. It has the same high transmissivity as glass, and is interchangeable with many standard glass refractors. One-fourth the weight of glass, it's far easier to install.
- General Electric's dependable cadmium-sulphide photoelectric control, which mounts right on the locking-type hood for automatic dusk-to-dawn operation. It's built and tested for years of reliable, trouble-free performance.
- Long-life ballasts built right into the hood for mercury lamps up to 250 watts (hoods without ballast for up to 6000-lumen filament). Since mercury lamps generally last two to three times longer than filament, this means far fewer service calls for relamping.

It all adds up to a luminaire you can install and forget. Whether it's for suburban streets, commercial establishments, or areas around private homes and farms, the General Electric Acrylic-Suburban can mean increased lighting profits for you. For full details and immediate shipment from stock, call your General Electric Apparatus Sales Engineer or Agent. General Electric Company, Outdoor Lighting Dept., Hendersonville, North Carolina. 460-01

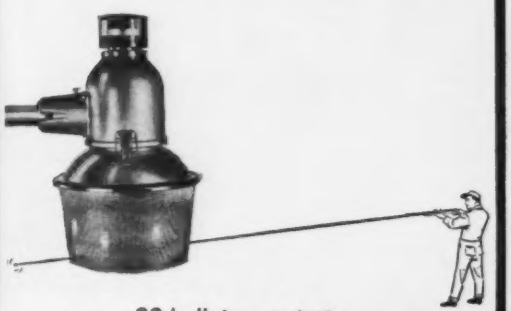
Progress Is Our Most Important Product

GENERAL ELECTRIC



resists thermal shock of cold rain

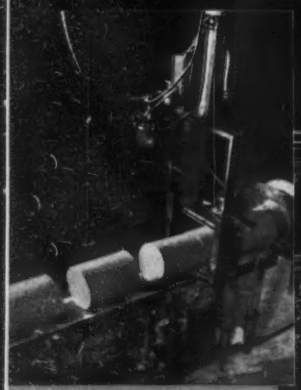
unaffected by corrosive atmosphere or blowing sand



.22 bullets penetrate but will not shatter

Modulus of rupture measurement, a routine laboratory check on strength of porcelain bodies, body-and-glaze combinations and sanded cementing surfaces.

At Lapp, suspension

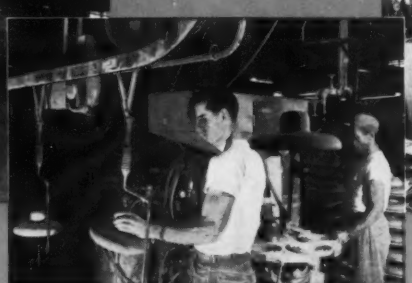


Uniformity of Lapp suspension discs begins with the billets of clay, automatically extruded and sliced to exact size.

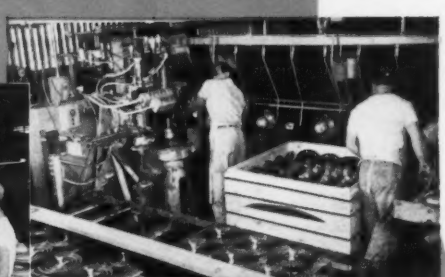
Automation all the way! Plunging of lower surfaces of suspension discs is by this automatic machine.

Plunged blanks, their moisture content controlled by an exact temperature-humidity-time cycle, are automatically trimmed to precise size and shape.

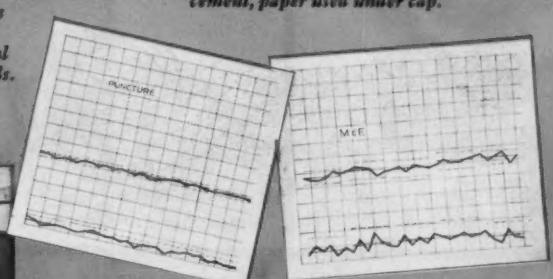
Uniform thickness of resilient paint on pins within insulator head is assured by this automatic pin-dipping machine.



Glazing is mechanized, too, by this machine which glazes insulator shells and applies uniform internal and external sand cementing bands.

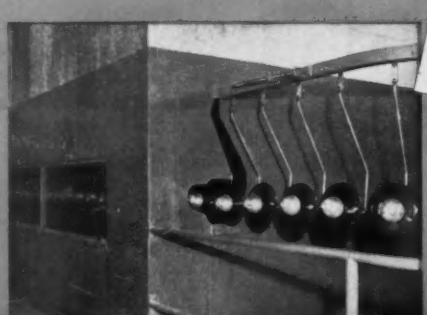


Mutiple-duty machine pulls each insulator at Proof Test Load and trims off surplus cement, paper used under cap.

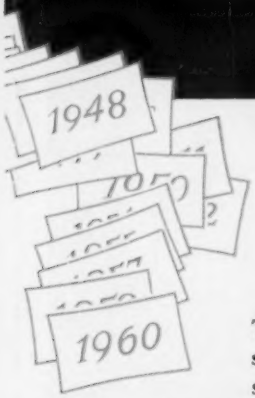


A fixed percentage of production is allocated to quality control testing. Charts like these, of M&E and puncture values, show the continuing improvements in characteristics and uniformity resulting from Lapp production mechanization.

Every Lapp suspension unit is tested mechanically and electrically. This conveyer carries finished insulators through 60-cycle flashover test for a minimum period of three minutes.



insulator design and production are matters of continuous improvement



we make 'em good...
...and keep making 'em better

Take a look at your last shipment of Lapp suspension insulators. Compare them with some of Lapp's 40-year-old veterans you'll find serving on lines all over the country. You probably won't notice much difference. Yet they're nearly as different as is today's Thunderbird from 1920's Model T.

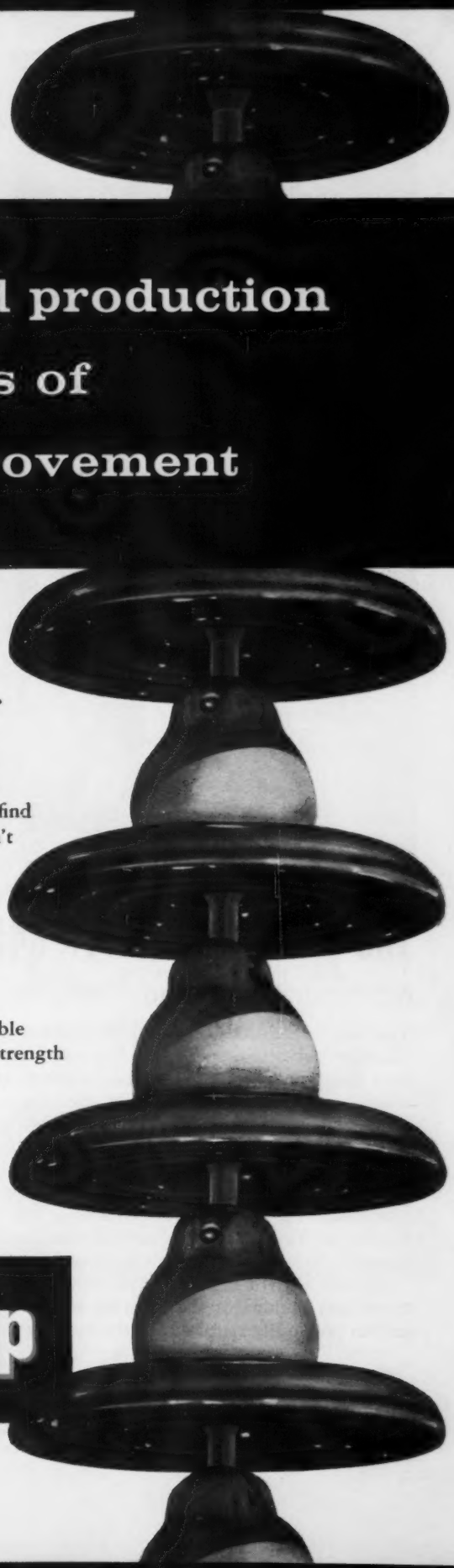
That's because product improvement is a continuous program with Lapp. We re-design, we test, we prove—and year-by-year we build valid improvements into our insulators and our production processes.

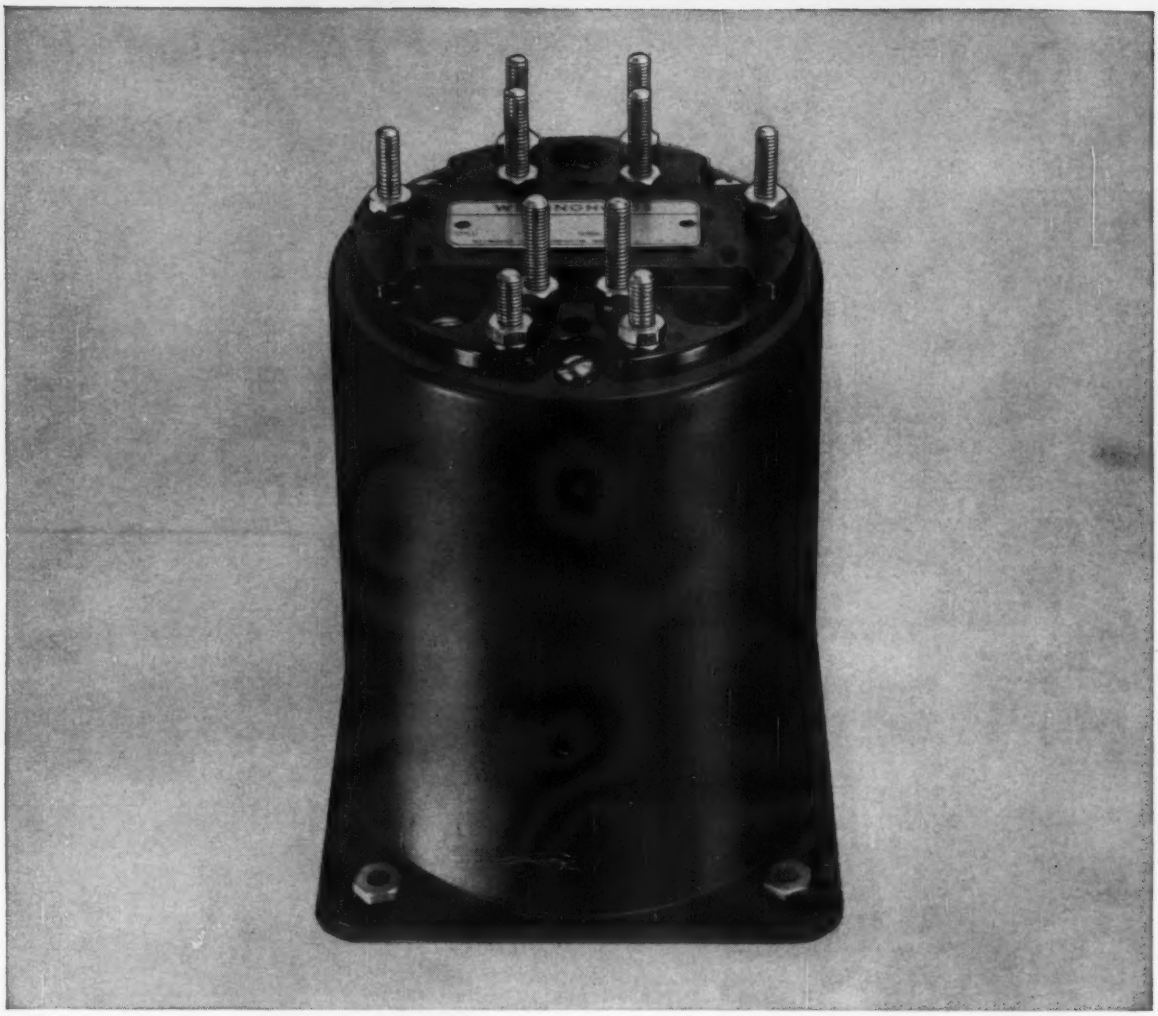
The results? Significant strengthening of every measurable characteristic. Elimination of even the maverick under-strength (and over-strength) individual units. Mechanization of every phase of production, for predictable uniform response to all test standards.

That's the way it is at Lapp. We make 'em good... but we keep making 'em better. And this extra we put into our suspension insulators merits your confidence when you install them, and means extra service after they're up.

Lapp Insulator Co., Inc.,
Le Roy, N. Y.

Lapp





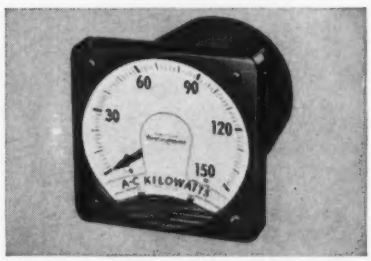
The Westinghouse VP-840 hall generator watt transducer

No moving parts, no tubes, no thermal elements

This new transducer utilizes the Hall Effect* principle to convert single-phase or polyphase watts into d-c millivolts. In addition to the fact that this transducer gives **instantaneous response, vital to automatic control,** it offers further advantages in that it provides high overload capacity and a considerable cost saving, too.

The VP-840 is supplied for either single-phase or polyphase circuits, with or without a built-in filter. **With a filter,** it operates high-impedance devices such as telemetering transmitters, high-gain servoamplifiers, or potentiometric type recorders. **Without the filter,** it is used with low-impedance devices such as direct-acting instruments for the measurement of watts or vars or with magnetic amplifiers in systems control.

Applied with a simple conventional d-c millivolt meter, this new transducer eliminates the complex multiple coil dynamometer mechanisms previously required for the measurement of power. J-40526



KP-241 wattmeters and varmeters incorporate the transducer circuit in a complete instrument assembly. Watts applied to the instrument terminals are converted to a proportional d-c voltage which operates our exclusive TBS (Taut Band Suspension) d-c instrument mechanism.

For a complete rundown on this revolutionary new development, call your Westinghouse sales engineer or write for Catalog Section 43-840, Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

*If a conductor carries a current at right angles to a magnetic field, a charge difference is generated on the surface of the conductor in a direction which is mutually perpendicular to both the field and the current.

YOU CAN BE SURE...IF IT'S Westinghouse

WATCH "WESTINGHOUSE LUCILLE BALL-DESI ARNAZ SHOWS" CBS TV ALTERNATE FRIDAYS

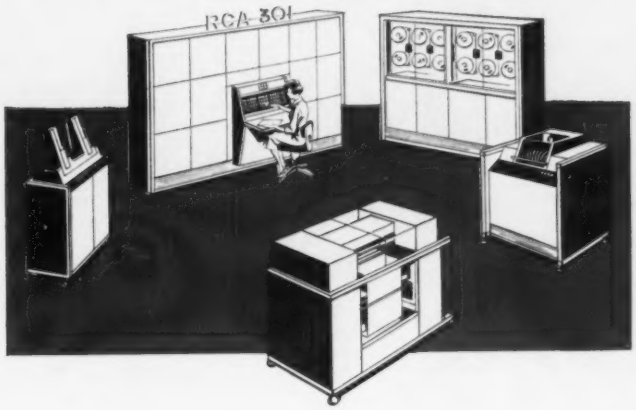
BIG NEWS

in ELECTRONIC DATA PROCESSING

Two new systems, latest in a series of EDP Advancements from RCA —world leader in electronics—join the established RCA 501

For Business in the Smaller Ranges • Divisional Operations

THE NEW RCA 301



COMPLETE, Compact EDP System at Low Cost... with Optimum WorkPower and Speed

- DATA STORAGE OPTION: magnetic tape or new design discs that switch easily for changing jobs—23 million character capacity
- HIGH VERSATILITY: paper tape, magnetic tape, punch card, *or combinations*, for input-output
- GREATEST CAPACITY, fastest core memory in price class—20,000 character storage; 7 millionths of a second access time; variable word length
- FULL SPEED—reads 600 cards/minute; prints 900 numeric or 600 alpha numeric lines per minute
- AUXILIARY ROLE—feeder or extender to 501 or 601 EDP Systems
- SIMULTANEITY OPTION permits large increase in workpower

For Large Business or Scientific Operations

THE NEW RCA 601

TREMENDOUS WorkPower . . . in Every Field of Data Processing . . . with Previously Unattainable CAPACITY—EXPANSIBILITY—ECONOMY

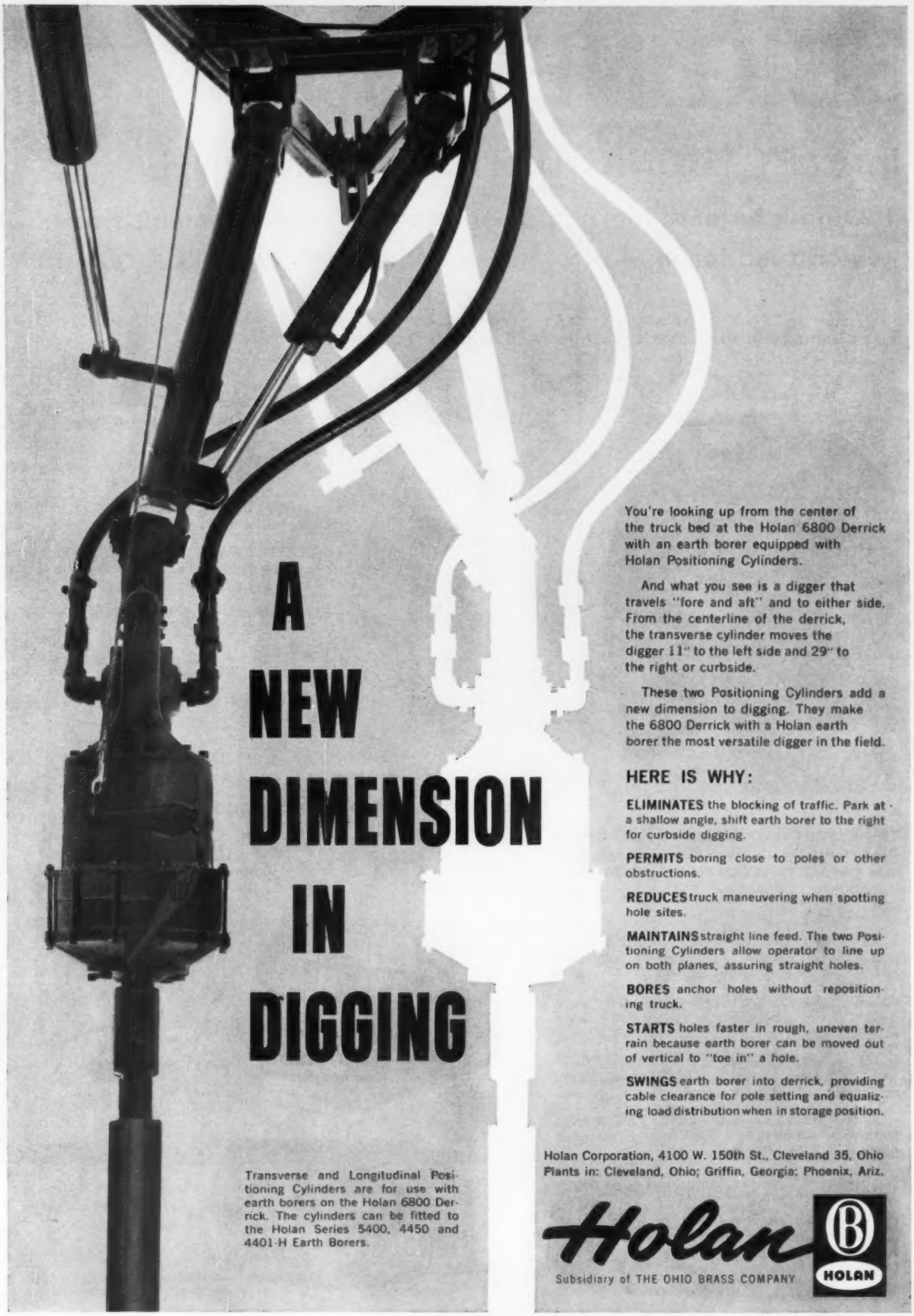
- ULTRA-FAST—to 180,000 digits/second with magnetic tape
- EXCEPTIONAL COMPUTING SPEED, 1.5 millionths of a second "add" time, 1.5 millionths of a second memory access time
- PARALLEL PROCESSING permits handling a multiplicity of independent programs with changeable priority
- UNPRECEDENTED COMPATIBILITY—with RCA data processing and communications equipment and other processors
- OMNI-CHANNEL INPUT/OUTPUT permits transfer of information to and from as many as 64 sources, with concurrent computing

For information about the complete transistorized line, write: Electronic Data Processing Division, Radio Corporation of America, Camden 2, New Jersey.

RCA

The Most Trusted Name in Electronics

RADIO CORPORATION OF AMERICA



A NEW DIMENSION IN DIGGING

You're looking up from the center of the truck bed at the Holan 6800 Derrick with an earth borer equipped with Holan Positioning Cylinders.

And what you see is a digger that travels "fore and aft" and to either side. From the centerline of the derrick, the transverse cylinder moves the digger 11" to the left side and 29" to the right or curbside.

These two Positioning Cylinders add a new dimension to digging. They make the 6800 Derrick with a Holan earth borer the most versatile digger in the field.

HERE IS WHY:

ELIMINATES the blocking of traffic. Park at a shallow angle, shift earth borer to the right for curbside digging.

PERMITS boring close to poles or other obstructions.

REDUCES truck maneuvering when spotting hole sites.

MAINTAINS straight line feed. The two Positioning Cylinders allow operator to line up on both planes, assuring straight holes.

BORES anchor holes without repositioning truck.

STARTS holes faster in rough, uneven terrain because earth borer can be moved out of vertical to "toe in" a hole.

SWINGS earth borer into derrick, providing cable clearance for pole setting and equalizing load distribution when in storage position.

Transverse and Longitudinal Positioning Cylinders are for use with earth borers on the Holan 6800 Derrick. The cylinders can be fitted to the Holan Series 5400, 4450 and 4401-H Earth Borers.

Holan Corporation, 4100 W. 150th St., Cleveland 35, Ohio
Plants in: Cleveland, Ohio; Griffin, Georgia; Phoenix, Ariz.

Holan

Subsidiary of THE OHIO BRASS COMPANY

HOLAN

Bechtel Experience at work . . . . .

FLORIDA POWER & LIGHT'S NEWEST AND LARGEST

First of two 240,000 kw generators began operating in April at the new 480,000 kw steam plant Bechtel is building for Florida Power & Light Company at Port Everglades. A second identical unit is scheduled to go into operation next spring and the plant is designed for ultimate expansion to 1,000,000 kw.

With this new giant at Port Everglades, and new units such as Bechtel completed in 1958 in expanding the utility's Fort Lauderdale plant, Florida Power & Light is keeping well ahead of fast-growing Florida's need for power. F. P. & L.'s continuous expansion program has increased system generating capacity nearly 400 per cent in the last dozen years.

Inquiries are invited from those who may be considering a steam, hydro-electric or nuclear power plant—or the expansion of existing generating facilities.

BECHTEL CORPORATION
SAN FRANCISCO · Los Angeles · New York · Houston

CANADIAN BECHTEL LIMITED
TORONTO · Montreal · Calgary

REVERE Dual Gauge TUBE

of 80/20 Cupro-Nickel

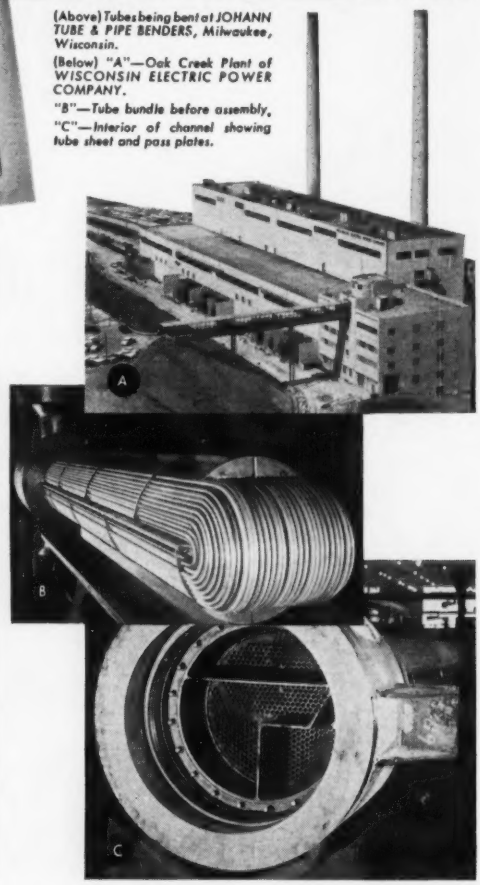
used in A. O. Smith's feed water heaters in newest installation at Wisconsin's largest power plant

(Above) *Tubes being bent at JOHANN TUBE & PIPE BENDERS, Milwaukee, Wisconsin.*

(Below) *"A"—Oak Creek Plant of WISCONSIN ELECTRIC POWER COMPANY.*

"B"—Tube bundle before assembly,

"C"—Interior of channel showing tube sheet and pass plates.



The six A. O. Smith Feed Water Heaters recently installed in the #4 unit of the Oak Creek Plant of the Wisconsin Electric Power Company, represent the fourth such set serving the four units. Heaters are 24" in diameter with overall lengths up to about 23'. Operating pressures are 2400-2500 psi. Enclosure and channel tested out at 4800 psi.

To take the kind of bending necessary in this "U" type heater, and still maintain the required wall thickness throughout its entire length, the tube must be of the best quality and of the proper, uniform grain structure.

Revere Mills have the facilities to produce just such consistently uniform tube while Revere's Technical Advisory Service has the knowledge to recommend the metal or alloy best suited to the job it must perform.

Whether your requirements call for dual or single gauge tube, why not take advantage of the vast storehouse of facts made available as a result of extensive data which has been compiled over the years by Revere's Research Department? Start the ball rolling by getting in touch with Revere's Technical Advisory Service.

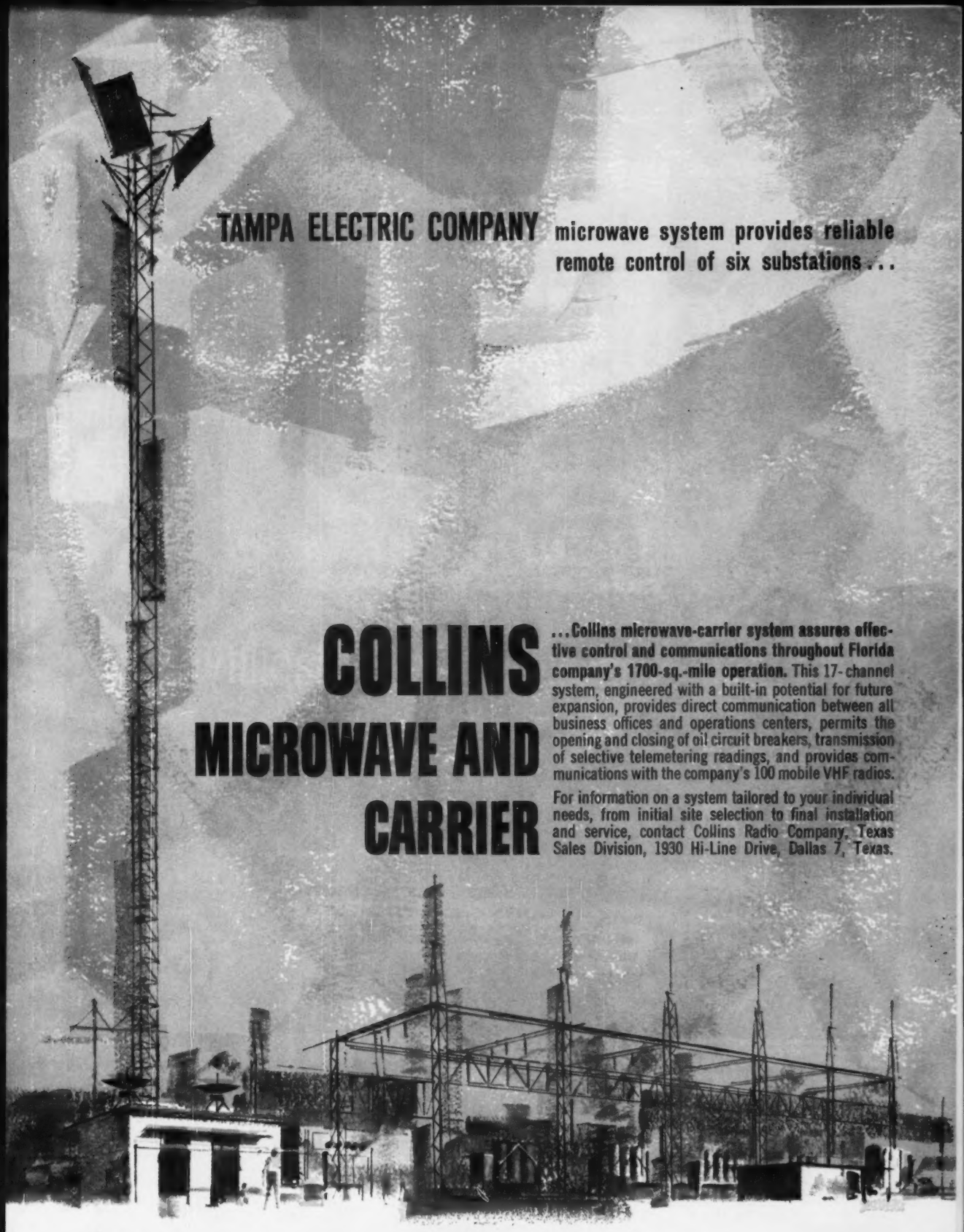
REVERE COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, N. Y.

Mills: Rome, N. Y.; Baltimore, Md.; Clinton and Joliet, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Brooklyn, N. Y.; Newport, Ark.; Ft. Calhoun, Neb. Sales Offices in Principal Cities, Distributors Everywhere.

COPPER * BRASS 1801 * REVERE * ALUMINUM



TAMPA ELECTRIC COMPANY microwave system provides reliable remote control of six substations . . .

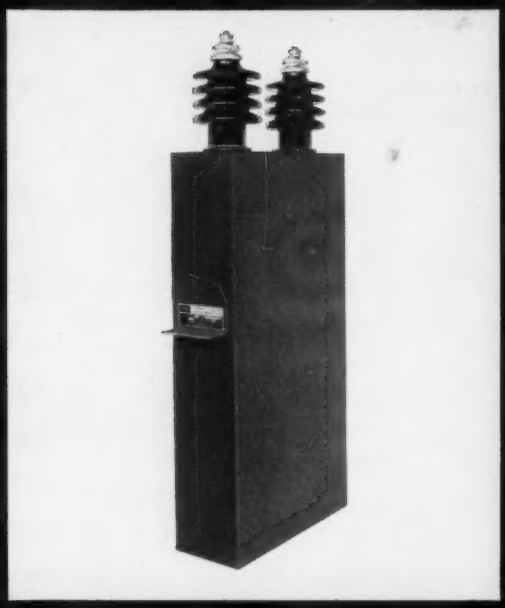
COLLINS MICROWAVE AND CARRIER

. . . Collins microwave-carrier system assures effective control and communications throughout Florida company's 1700-sq.-mile operation. This 17-channel system, engineered with a built-in potential for future expansion, provides direct communication between all business offices and operations centers, permits the opening and closing of oil circuit breakers, transmission of selective telemetering readings, and provides communications with the company's 100 mobile VHF radios.

For information on a system tailored to your individual needs, from initial site selection to final installation and service, contact Collins Radio Company, Texas Sales Division, 1930 Hi-Line Drive, Dallas 7, Texas.

COLLINS

COLLINS RADIO COMPANY • DALLAS, TEXAS • CEDAR RAPIDS, IOWA • BURBANK, CALIFORNIA



Same Consistent Dependability...
Same High Quality...
Proud NEW Nameplate

FPE CORNELL – DUBILIER
POWER CAPACITORS

For over 50 years the name Cornell-Dubilier has stood for leadership in Power Factor Capacitors. Now this fine line of equipment joins the fastest growing family of quality products for electrical distribution, control and power. Importance to you? Beyond the advantages in completeness of line and single source responsibility, it means Federal Pacific service and distribution facilities extend to the finest line of reliable capacitors...with the same high standards of quality and dependability. Now available through your local Federal Pacific office.

FPE **CORNELL-DUBILIER POWER CAPACITORS**
FEDERAL PACIFIC ELECTRIC COMPANY • 333 HAMILTON BOULEVARD, SO. PLAINFIELD, N. J.

The Electrical Week

LATE NEWS ▶ **Around the states** . . . Decatur, Ind., will sell its system to Indiana & Michigan Electric for $2,099,100 . . . PUD's in Oregon must pay state's corporation excise tax, Oregon Supreme Court declares . . . Washington WP gets $830,000 a year rate hike for Idaho customers.

Housing of the newly arrived 230-ton carbon-steel vessel in its 160-ft dia containment sphere began May 3 at Con Edison's Indian Point Nuclear Plant, promised for operation in 1961.

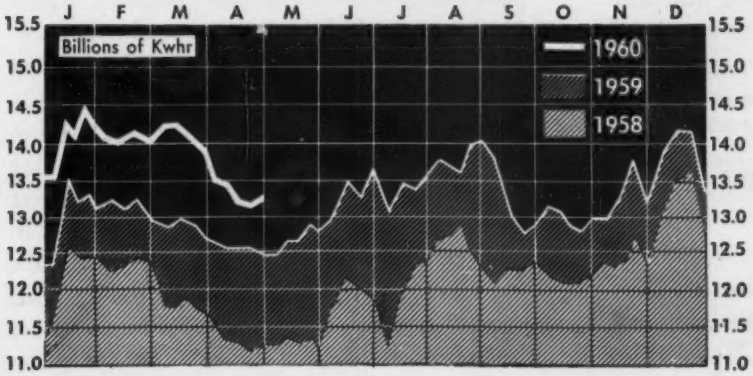
IBEW claims it is taking the initiative in closing the scientific gap between journeyman electrician and graduate engineer. Joseph Keenan, international secretary, says union is organizing a training program for union members.

Power reactor planned by Florida West Coast Nuclear Group is being redefined and may even be called off. Philip Sporn, president of the group, says recent cost estimates have increased so sharply, and area conventional fuel costs declined so abruptly, construction figures were upped from $26 million to $29.5 million.

Canadian Westinghouse gets three 8,500-hp gas turbines order to act as compressor drivers for natural gas export lines to U. S.

Management changes . . . E. L. Lindseth elected chairman, and R. M. Besse, president at CEI . . . R. A. Olson becomes president, Kansas City P&L . . . W. C. Schmidt named Consumers Power vp . . . PS of Indiana makes H. A. Barker, financial vp; H. B. Christianson Jr, vp-Northern Division; and R. W. Rink, vp-Western Division . . . Northern States Power elects J. R. Furber a vp . . . R. F. Bovier becomes vp, Pennsylvania Electric Co . . . P. R. Mallory elects G. Barron Mallory, president . . . L. G. Maechtlen named Square D president, succeeding G. Patterson, resigned.

WEEKLY POWER OUTPUT—Up 6.0% (Week ending Apr. 30), Kwhr 13,300,000,000



Per Cent Change From Previous Year

	Apr. 16	Apr. 23	Apr. 30
Total U. S.	+ 5.2	+ 5.4	+ 6.0
New Eng.	+ 5.4	+ 6.6	+ 4.7
Mid. Atlan.	+ 5.1	+ 4.6	+ 6.2
Cent. Ind.	+ 3.8	+ 3.2	+ 3.9
West. Cent.	+ 5.4	+ 3.4	+ 6.5
Southeast	+ 3.6	+ 4.2	+ 6.4
South Cent.	+ 8.8	+ 7.1	+ 5.7
Rocky Mount.	+11.6	+ 9.0	+11.4
Pacific			
NW	+ 8.1	+15.2	+ 9.5
SW	+ 5.1	+ 7.0	+ 6.8

Seasonally Adjusted Index 269.2

2 Weeks Ago 267.3* Year Ago 252.4

*Index adjusted to compensate for leap year.

Source: Edison Electric Institute

Preview of This Issue

EVENTS ▶ **American Public Power Assn speakers lash out** at private power at the 17th annual convention **(p 44)** . . . Senate fight seen over dropping of William R. Connole from Federal Power Commission, and selection of two new commissioners **(p 46)** . . . Russia proposes joint development of European fuel resources and plans hydro project with Norway **(p 47)** . . . Berea, Ohio, has ten years of experience after selling system to investor utility. Case history is presented **(p 48)** . . . Europe cuts back on nuclear power projects. Report includes both Euratom and Eastern Europe events **(p 99)** . . . Navajo Indians block plans for transmission line to Hopi reservation **(p 97)** . . . Tree clinic is part of Cleveland Electric long range plan for eliminating distribution system damage from falling branches **(p 96).**

ENGINEERING ▶ **Loss-of-excitation relaying can protect generators of large size,** a computer study on Wisconsin Electric Power Co's system shows **(p 51)** . . . The reliability of diesel generators used for peak shaving is indicated in a recent Philadelphia Electric Co study. Only 0.85% of starts missed or failed to come up to speed **(p 54)** . . . Looking for ways to cut distribution costs? Then be sure to read the story on Westinghouse's approach to the problem, using secondary regulators **(p 56).**

Politics and Public Power

WHITHER PASSAMAQUODDY?

The alignment of factions for and against the Passamaquoddy Tidal Power Project at a recent public hearing in Calais, Maine, was just as it was expected to be: Support came largely from state and local groups that see the project as a means for "economic rejuvenation of the area," and opposition came from the private utilities, and the fishing and conservation interests. Significantly, it came also from an independent engineering group.

Testimony at the International Joint Commission hearing came from about 30 persons, who were about evenly divided on the project. It's still an open question which way 'Quoddy will go.

Utility opposition—more specifically, Electric Council of New England opposition—was voiced by Albert A. Cree, ECNE president. Cree told the IJC that "The tidal project makes no sense whatever." Basing his position on a report prepared by the Boston consulting firm of Charles T. Main, Inc, Cree pointed out that the U. S. share of the St. Lawrence project, for 20% more cost, provides seven times the power. The Main report estimated the cost of the tidal project alone at $5,478 per kw and $2,850 per kw firmed (including Rankin Rapids project). This compares to $450 per kw for St. Lawrence.

Also speaking against the proposal was an independent special committee of Maine engineers, which said 'Quoddy power "is not cheap power. It is far more costly than that from alternate sources." Its conclusion: "Power from the proposed tidal project with the river auxiliary cannot compare in cost, even by stretching every possible factor to the breaking point, with steam or suitably de-

PROCUREMENT & PRODUCTS ▶ **Electrical manufacturers hold annual meetings.** Top executives review foreign competition, low prices, foreign "sourcing," and the upswing in new orders (p 78) . . . Oil circuit breaker has a single tank for all three phases . . . Post insulators permit stacking identical units . . . Capacitor vacuum switch is for all-weather, outdoor application (p 91) . . . Supreme Court jury in Canada indicts Canadian Electrical Contractors Assn on charges of conspiring to lessen competition . . . TVA checks coal deliveries with sampling tube (p 76).

MANAGEMENT ▶ **Thinking of paying a stock dividend?** Not many utilities are, but if your company is one which is, your wealthy stockholders will probably applaud. For your average stockholder, however, it may be cause for concern. Actually, both—or neither—may be the case, depending on the way you do the job. For a rundown on the pros and cons of stock dividends, and some tips on pitfalls, turn to **page 85.**

SELLING ▶ **The battle between electricity and gas will be stressed** in the Live Better Electrically program for 1961. The word "flameless" will be used in all ad copy (p 75).

NEXT WEEK ▶ **Be certain to read EW's Fifth Nuclear Report. Two colors, 20 pages.**

veloped hydro power." John R. Newell, a member of the group and president of the Bath Iron Works, Inc, told the IJC his firm spends $300,000-$400,000 a year on power and "If cheap power were possible from the proposed project, I'd be for it—but it isn't. If you want to build a $687-million tourist attraction, that's something else!"

'Quoddy drew support from Maine's Gov John H. Reed who said, "We have undertaken a broad program of industrial development . . . this new source of power at reasonable cost would enhance that program."

Sumner Pike, representing the Governor's Committee on Passamaquoddy Development, also played up the industrial development aspects. In addition, Pike also pointed to the project as a boon to the tourist business.

Which way will 'Quoddy go? It is too early to say, but some of the factors affecting it should be examined:

There is no question that the project has great local political appeal. The area around 'Quoddy can properly be termed an economically depressed one. One area spokesman put per capita income at about $1,000 a year. 'Quoddy would be a shot in the arm, and Maine's delegation to Congress knows this.

Then, too, "down Easters" have, through taxes, been supporting federal power developments in the South and West for decades, and some feel it is about time they got some government money up there.

But there is the stark fact—asserted by the IJC's engineering report and backed up by other studies—that 'Quoddy is not economically feasible now.

Finally, there is the role of Canada, at best a reluctant partner whose thinking on 'Quoddy to date is anything but positive.

Executive Reader

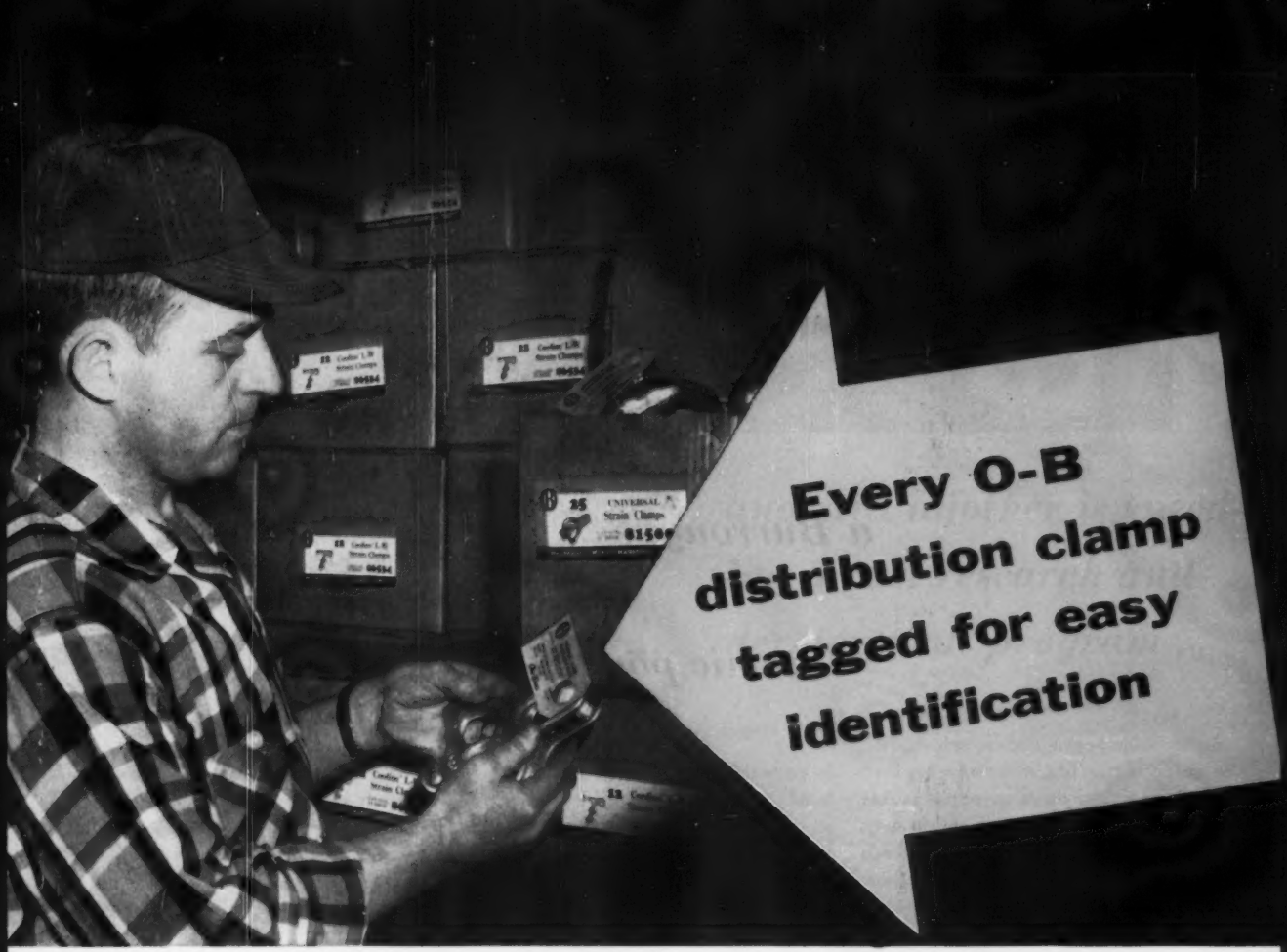
About 25% of the old jobs are eliminated when an electronic digital computer is moved into an office to handle data processing. However, attrition and shifting of jobs, rather than outright firing, take up most of the slack. This is reported from a Labor Dept survey of 20 major oil, insurance and utility companies that adopted EDP in 1957. Of some 2,800 workers involved, only about 2% assumed purely computer jobs. **Business Week, April 30, 1960.**

From what is probably the first successful effort in providing electricity to a farm in 1898, to an estimate of 15,000 kwhr annual average farm use by 1975, the booklet "Rural Electrification in the United States" tells the story of the efforts of private companies in taking central station service to rural customers. The 48-page booklet is based on records of electric companies, electrical manufacturers and farm groups, plus information from trade journals, newspapers and federal agencies.
(Single copy 90 cents; lower unit prices for bulk quantities.)
Edison Electric Institute, 750 Third Avenue, New York 17, N. Y.

Labor turnover is beneficial from the standpoint of the working man, based on evidence in the area of economic theory. In general, management regards labor turnover as costly and wasteful. The wide area between these two views is covered in a study that investigates the methods of measuring labor turnover; the calculating of the cost of labor turnover; related factors in labor turnover; and how to attack the problem. (Cost to AMA members, $3.50 per extra copy; to others $5.25 per copy). **Labor Turnover: Calculation and Cost, Frederick J. Gaudet, AMA Research Study 39, American Management Association, Inc, 1515 Broadway, New York 36, N. Y.**

Private placement of blocks of utility common stock would lower the cost of such a stock sale and would avoid the diminution in market price that usually follows announcement of a public sale. Private placement could be made with such groups as investment trusts, "stock" insurance companies, pension trusts, mutual life insurance companies, and some savings banks. Such a plan would allow issuance of stock more often and in smaller amounts. **Why Not Private Placement for Utility Shares?, Willard F. Stanley, Public Utilities Fortnightly, April 28, 1960.**

Guidelines for independent inspection of wood members of power lines cover the desired scope of a routine for the inspection of wood products prior to preservative treatment; preservatives; treating equipment and processes; and wood products after preservative treatment. **Bulletin 44-4, Rural Electrification Administration, U. S. Dept of Agriculture, Washington 25, D. C.**



You're never in doubt

From storeroom to pole top, an O-B distribution clamp is easy to identify by its bright orange tag. Fixed beneath the rivet head . . . removed with a tug . . . the tag clearly shows a clamp's catalog number, range of conductor sizes, and type . . . information that helps you pick the right clamp for the job.

Tagging an O-B Strateline, Cooline L-W or Universal clamp adds nothing to its cost . . . but does add to your convenience in handling every step of the way . . . filling stock requisitions, on the line-truck, and at the job site.

This simple tagging system puts all the information you need at your finger tips. Although clamping range in inches-diameter has been cast into the body of O-B clamps for many years, the tag supplements this by giving the range in terms of conductor size (AWG or MCM) of ACSR, all aluminum, and copper cables. Since the catalog number shows on the tag, confusion with the body casting number is also eliminated.

If you have ever had the wrong distribution clamps delivered at the job, you'll appreciate tagged clamps . . . and the tags identify quality products.

OHIO BRASS COMPANY, MANSFIELD, OHIO
Canadian Ohio Brass Co., Ltd., Niagara Falls, Ont.

Distributed by GraybaR ELECTRIC COMPANY

Ohio Brass

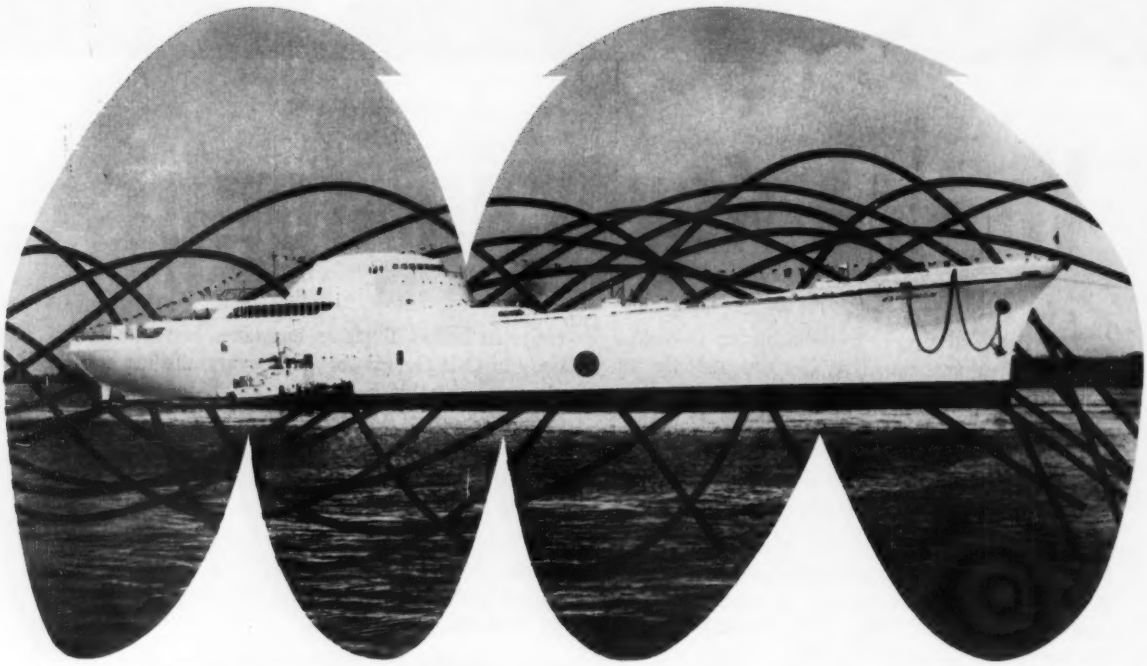
HOLAN

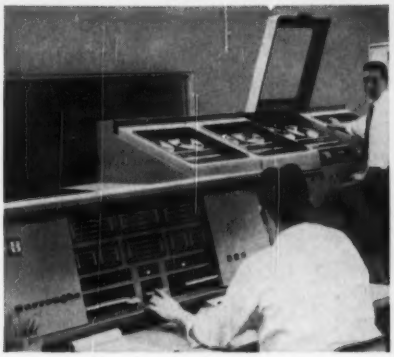
PORCELAIN INSULATORS • LINE HARDWARE • CAPACITORS • LIGHTNING ARRESTERS
BUSHINGS • HOLAN TRUCK-MOUNTED POWER DEVICES AND BODIES • BRONZE VALVES

10041-H

For the Babcock & Wilcox Company:

a Burroughs 205 computer backed the team that introduced atomic power to the merchant fleet...





another Burroughs computer is helping build one of the world's largest steam boilers...

and still another is speeding a vast research and development program

History has already earmarked July 21, 1959, in remembrance of launching the N. S. Savannah—the world's first nuclear merchant ship. This graceful queen of the seas may well be the precursor of a vast atomic merchant fleet—ships operating quietly and efficiently on nuclear engines.

Yet months before touching water, the Savannah's nuclear propulsion system was obtaining hundreds of "trial runs" on a Burroughs 205 computer at The Babcock & Wilcox Company's Atomic Energy Division in Lynchburg, Virginia.

Long before the vessel was launched these computer runs predicted changes that were to take place in the heart of the nuclear reactor. With the aid of these data, decisions were made as to the optimum size of the reactor, the lifetime of the fuel elements, amount of fuel needed, approximate costs and myriad other specifications.

Of course, a simulated run could have been made with a desk calculator—but it would have taken one year to complete a single run. The 205 has completed the same job in just a few hours.

This is the latest installment in a success story that started in November, 1955—the installation date of the Burroughs 205 at the Atomic Energy Division. Aside from the N. S. Savannah project, the same computer contributed immeasurably to other reactor designs, and other engineering work involving stress and thermal calculations, plus cost accounting data processing.

A recognized pioneer in the application of electronic data processing equipment, B&W was one of the first companies to develop its own automatic programming system. The effect of this powerful programming aid—called DUMBO—is to extend the capabilities of the 205 to hundreds of engineers without special knowledge of computer characteristics and techniques.

B&W engineers at Lynchburg are now able to write a plan for the computer to follow; DUMBO then automatically translates the plan into 205 language for electronic data processing.

With valuable 205 experience on design problems of a different nature, B&W's Boiler division (at Barberton, Ohio) has now installed a larger Burroughs 220 computer system to handle its increasing activities. Now in the design stage, with the aid of the 220, is one of the largest steam boilers ever conceived. When finally erected, the new steam boiler will stand as high as a 22-story skyscraper, produce 4,900,000 pounds of steam per hour, and generate sufficient power to light a city of 5,000,000 population.

Whether designing mammoth power equipment or a small industrial boiler, the Burroughs 220 has become a vital tool from initial bid through final design. The Burroughs 220 is helping to win orders with fast-but-realistic proposals, slashing costs and lead time at every possible opportunity.

B&W, whose product range includes tubular products, refractories, and marine boilers, as well as stationary steam generators, is also spearheading the development and construction of nuclear stationary and marine propulsion power plants. In all these programs, B&W depends upon the most modern analytical processing equipment.

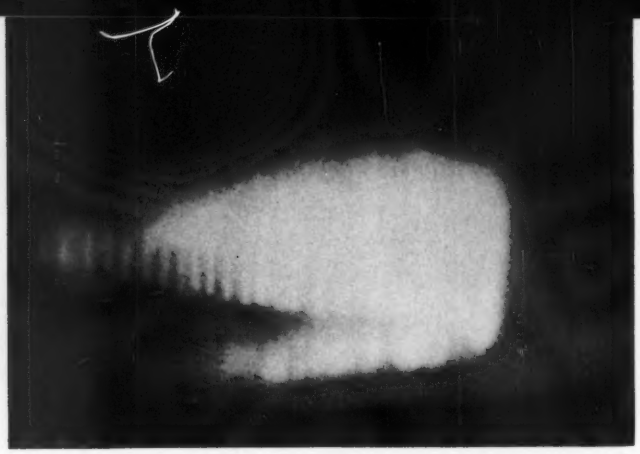
At the company's Research and Development Center based in Alliance, Ohio, a third Burroughs computer has recently gone "on the air." This Burroughs 205 was purchased to process data for a variety of research experiments in the fields of heat transfer, fluid flow, stress analysis, and thermodynamics. Its immediate impact has been to free creative engineering talent from routine calculations and to reapply valuable human resources to the pursuit of new sources of economical energy. This 205 has already developed research data otherwise inaccessible.

All three Burroughs computers are helping B&W to meet a wide range of the nation's power requirements in the most efficient and economical way possible. Hundreds of other industrial and commercial users are confirming similar experiences.

Burroughs' complete line of electronic data processing equipment is backed by a coast-to-coast team of computer specialists, able to advise on how Burroughs can help you in your business. For additional information, write General Manager, Data Processing Systems Group, Detroit, Michigan.

Burroughs Corporation

"NEW DIMENSIONS/in electronics and data processing systems"



Corona effect—beautiful to look at

The Aurora Borealis is a spectacular sight to see but it knocks out communication systems all over the world. In high voltage power cables, corona effect or ionization creates ozone which causes rapid deterioration of ordinary rubber insulation.

Years ago, engineers at American Steel & Wire took steps to correct this situation. They developed PS shielding with semi-conducting rubber tape wrapped around the conductor and over the insulation. This eliminated air gaps which might cause spark discharge and provided the best possible contact between conductor and insulation. Semi-conducting rubber shielding has since been adopted by the industry.

Another development, butyl rubber insulation, combines outstanding resistance to the effects of ozone, with heat stability and high moisture resistance.

In USS Tiger Brand Cables, this insulation is known as Amerzone B. It will withstand current loadings resulting in copper temperatures of 90°C.

The combination of PS shielding and Amerzone B insulation in Tiger Brand Cables (5 to 15 KV), plus an Amerprene 90 cover, provides a power cable with outstanding reliability and performance.

Such cables can be used for installation in ducts or for direct burial in earth, for aerial use, and many other high voltage applications. For more information, write for our booklet, "Tiger Brand Power Cables," which covers Amersheath Type RR Cable and Metallic Parkway Cables. Address American Steel & Wire, Dept.0222, 614 Superior Avenue, N. W., Cleveland 13, Ohio.

USS, Tiger Brand, Amerzone and Amersheath are registered trademarks

USS Tiger Brand Electrical Wire & Cable—A standard cable for every special job

Asbestos Wire and Cable • Varnished Cambric Cable • Mold-Cured Portable Cord • Interlocked Armor Cable • Shovel & Dredge Cable • Special Purpose Wire & Cable • Paper & Lead Cable • Aerial, Underground and Submarine Cable

American Steel & Wire
Division of
United States Steel

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors
Tennessee Coal & Iron Division, Fairfield, Ala., Southern Distributors
United States Steel Export Company, Distributors Abroad

. . . but dangerous in cables

Corona eliminated
Test showing two conductors both insulated with "ozone-proof" rubber, but the one on the left is not shielded and shows corona. On the second conductor, Type PS shielding prevents corona formation.

Here are answers to some about KPF switches

Q. *How can KPF switch blades maintain positive contact with switch clip under changing line sag conditions?*

A. Two heavy copper clips, bolted to a shoe carrying the flexible jumper, are mounted inside a special "horseshoe shaped" casting by two toggle bolts. These toggle bolts pass freely through the outer leaves of the clips, and the entire contact assembly "floats" on these bolts. Half-spherical bolt heads and adjusting nuts permit movement in any direction. The tension of the clip leaves on the blade is sufficient to insure positive alignment, since either clip or blade can follow the other to conform to line sag changes.

Q. *How can insulator stacks follow normal line sag changes?*

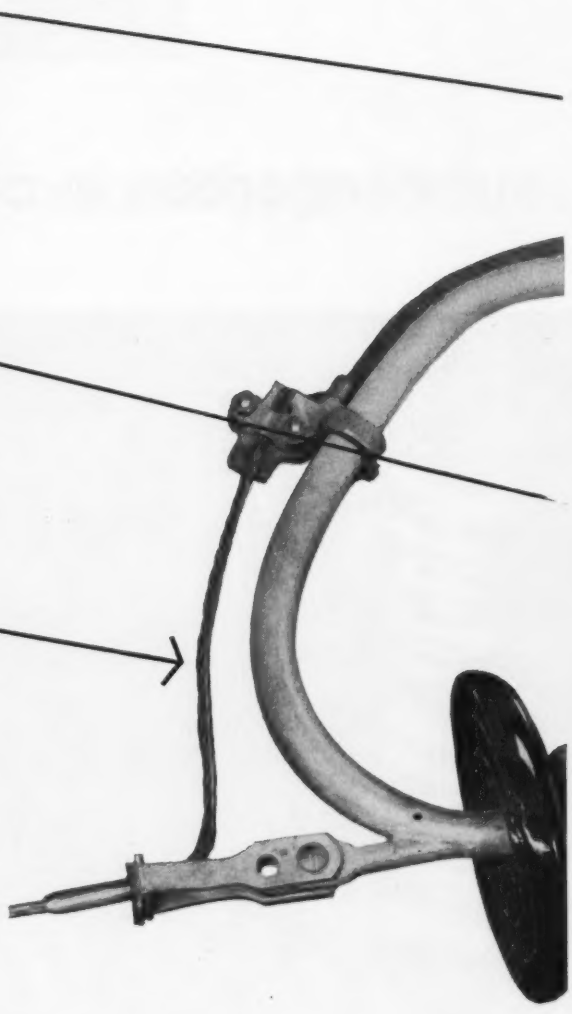
A. The insulator stack bearing units may be likened to limited universal joints. The actual bearing, a monel pin in an everdur trunnion, allows 90° movement of the rotating arm of the phase unit, as well as approximately 7° vertical movement to follow line sag. It is impossible for the bearing to bind under normal line stress, and insulator stacks always follow the sag of the conductor.

Q. *How are conductors connected to KPF switches?*

A. With KPF Type A switches, the user eliminates dead-end insulators. Any standard strain clamp can be used, and hot lines may be dead-ended directly to the phase units. Switch arms and dead-end eyes are integral with the insulator assembly. The conductor is lead through the strain clamp and on to a copper terminal on the switch arm. Aluminum conductors may be connected to the switch arm through special KPF terminals designed for this service. Type A switches may be mounted on a separate crossarm with conductors deadened below or above (for angle-pole installations, etc.). Switch operates equally well with or without line tension.

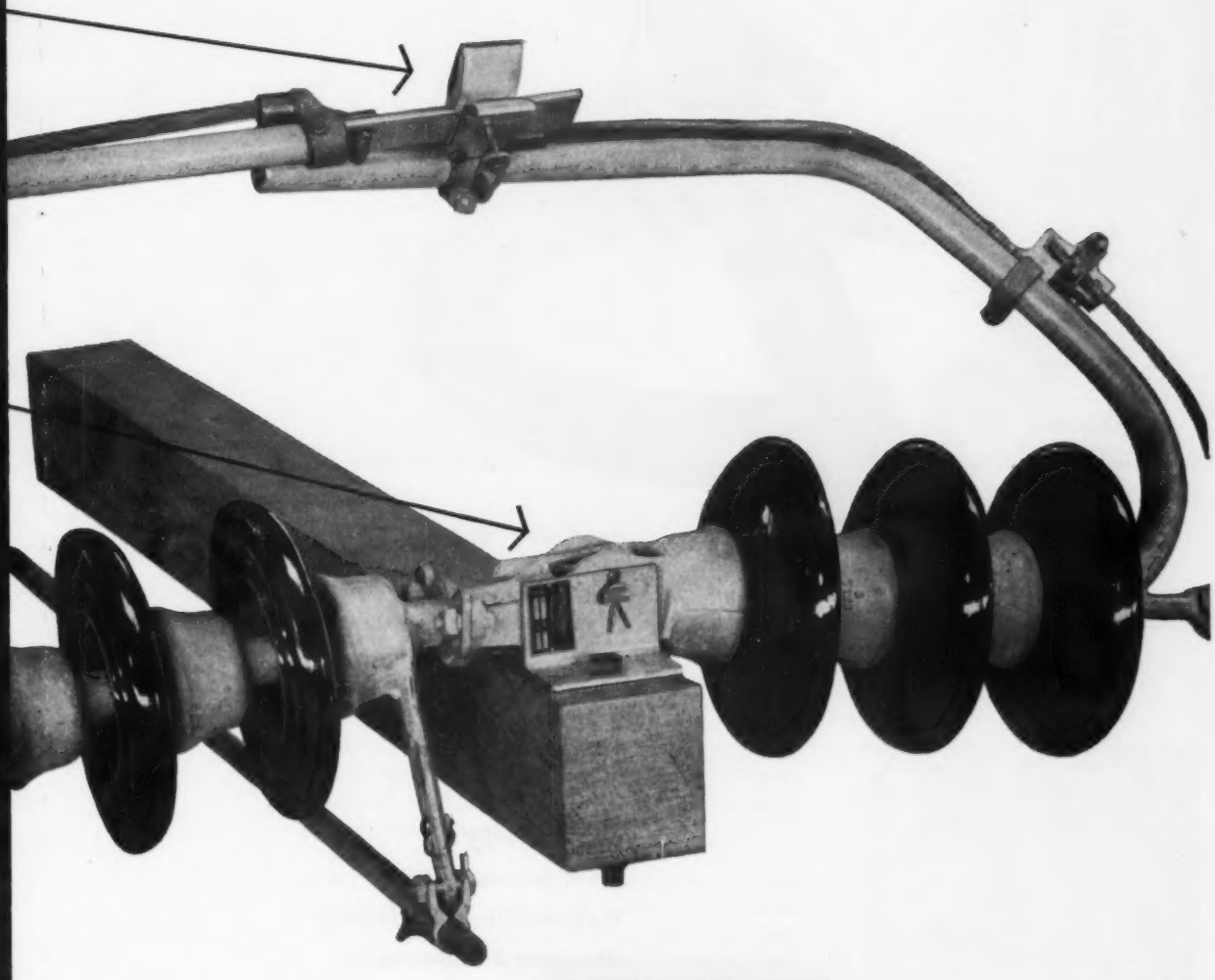
Q. *For what voltages are KPF air break switches available?*

A. KPF Type A and S standard "line-tension" switches are available for common voltages from 7.5 to 110 KV. Special switches combining a disconnect with a fuseholder (Type UF, double-cross-arm mounting) and for use where line tension is not present are also offered in these same voltage ranges. Ground switches are available for Type A or S switches. Type R switches are offered for use where line tension is not present or it is desired to use a specific type of apparatus insulator.



Request Catalog or write for details.
Test on your system this month!

often-asked questions



KPF

AIR BREAK SWITCHES

Standard for half a century

KPF ELECTRIC COMPANY

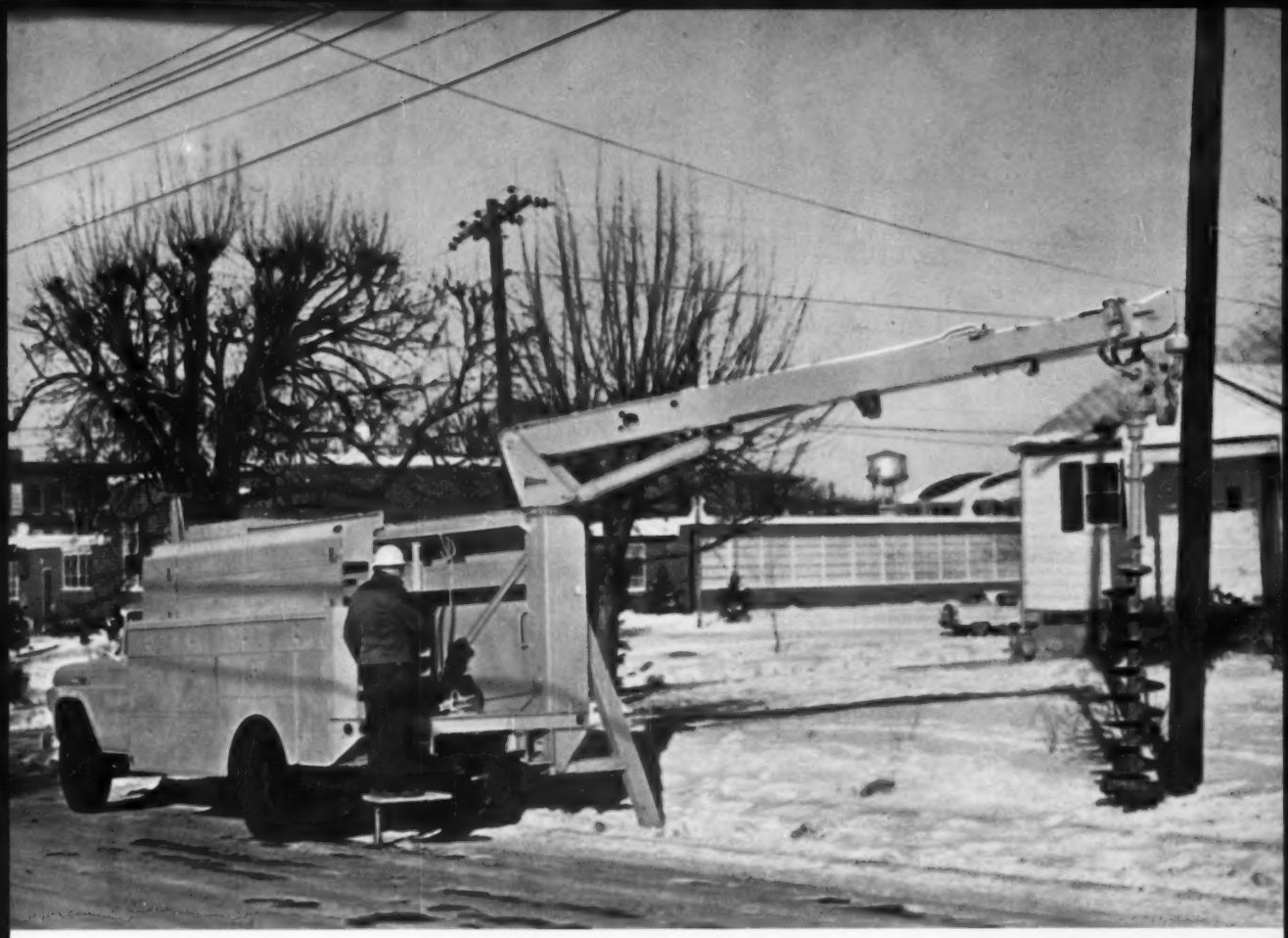
P.O. Box 1257E • Stockton, California

HOward 4-8381

5218

This is the SYMBOL of Pitman

and its completely new concept in hydraulic equipment designed especially for the electric utilities



replace muscle with the new

PITMAN POLECAT™

...makes your operator a one-man gang!

Community demand is growing by leaps and bounds. Your expansion program will have to hustle to keep up with it—and the way to do this is *not* by adding costly muscle-power . . . but through a fleet of versatile Pitman Polecats!

The all-hydraulic Polecat is much more than just another modified A-frame. It combines the functions of a digger, derrick *and* insulated crowsnest . . . does all three better than single-purpose units on the market. It makes best use of skilled men, eliminates more specialized vehicles; yet, with all its unique flexibility and performance, the Polecat is sensibly priced. It will quickly pay for itself—many times over—in increased crew efficiency.

This compact unit can be used with almost any utility line body, new or in-use. It can be center-mounted behind the cab, or installed in either rear corner, according to your individual requirements. Turn this page for more details . . .

the new

PITMAN POLECAT™

...changes its skills to match the job at hand!

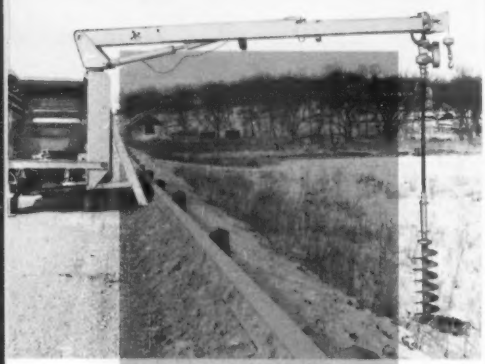
Digs all these holes from one truck position! Boom rotates 360° in either direction, digs holes in a circle from 24′ to 40′ in diameter. Digger head transfers instantly from basic boom to extendible tip simply by pulling and replacing a steel pin. Operator digs precisely, close to obstructions. Boom-tip inches in or out to keep hole straight. Same control digs holes for dead-end anchors, angling in any direction.

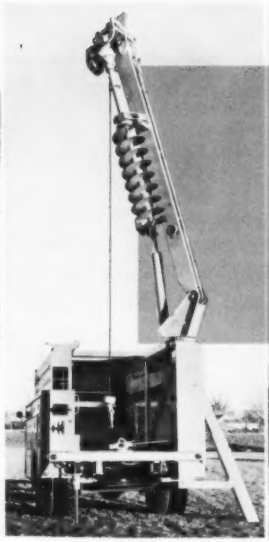
Auger hurdles walls, hedges, ditches, fences! With digger pinned to extended boom, Polecat reaches over guard rail to dig at foot of steep bank. Telescoping extension, built into digger shaft, permits full-depth holes far below road level. Hydraulic down-pressure sufficient to chew through frost, shale, hardpan.

Doubles as hydraulic derrick, loads its own truck bed! With digger stowed and pinned to basic boom, "stinger" can extend from 14′ to 22′ as a derrick. Reaches over obstructions to lift 8,000 lbs. Deck stays clear for materials.

Boom reaches 32 feet up, under full load, to lift replacement pole into position. Handles 40′ to 60′ poles easily. "Stinger" inches in or out to position heavy transformers on poles, too. Boom revolves, raises and extends simultaneously. Control panel in a choice of locations.

Fiberglass boom extension locks into extendible boom-tip, supports one or two fiberglass buckets for work on hot lines. Non-conductive rope runs over sheave in end of extension, lifts transformers up to 40′ above ground.





If you'd like to see this remarkable machine in action, your Pitman Distributor will be glad to oblige with a thorough demonstration. Or, simply contact . . .

PITMAN MANUFACTURING CO.

12725 Pitman Road • Grandview, Missouri

Telephone: SOuth 1-1851

PITMAN MANUFACTURING (CANADA) LTD., TORONTO

Up high at low cost in safety

the new PITMAN PELICAN™

Now your crewmen can work aloft in mechanical and electrical safety. No more bobbing ladders or dangerous, swaying crowsnests – the operator simply steps into the Pelican's fiberglass bucket, presses the easy-to-use control levers, and sweeps aloft in seconds!

The rigid fiberglass boom holds him steady with no "creep," even if hydraulic lines were to be damaged. He can change position instantly, with all the precision of a high-priced machine.

There's no longer any need to "ground" highly-skilled men when their climbing days are past. The Pitman Pelican puts them back to work – at jobs up to 40 feet high – faster and more safely than with old-style ladders or irons . . . and at far less cost than other aerial devices on the market.

Yes, the Pitman Pelican costs even less–in initial investment and maintenance–than old-fashioned powered aerial ladders. Available in 28′, 32′ and 36′ sizes; can be mounted (depending on size) on most ¾ to 1½ ton trucks. Turn this page for more details . . .

for the cost of a powered ladder,

you can put your men aloft in this

PITMAN PELICAN™

the lowest-cost all-hydraulic fiberglass aerial bucket

Lightweight fiberglass bucket levels itself hydraulically, has 300 lb. capacity. Unit is designed for use without outriggers, although spring lock-outs or torsion bars are optional, if desired. Boom revolves 360° in either direction, elevates to 75° above horizontal, extends to full reach in seconds. Entire telescoping section is fiberglass.

The Pitman Pelican is ideal for work on electrical distribution lines, street light maintenance, tree trimming and other high work. Note convenient controls on rear lip of fiberglass bucket; dual controls on truck also rotate, extend and raise boom simultaneously.

Pelican's compact design permits installation on most popular-sized utility line trucks; for example, a 28′ Pelican mounts on most ¾ ton trucks. Note wide passage on either side of pedestal, making truck deck accessible.

Pelican trims for travel in moments. Operator simply retracts boom, rotates it into forward carrying position, and tips it (hydraulically) up into the yoke. Overhead clearance is less than ten feet when stowed for travel.

Your nearest Pitman Distributor will be happy to demonstrate this low-cost, high-reaching aerial bucket—a card or a call will do. Or, simply contact . . .

PITMAN MANUFACTURING CO.

12715 Pitman Road • Grandview, Missouri

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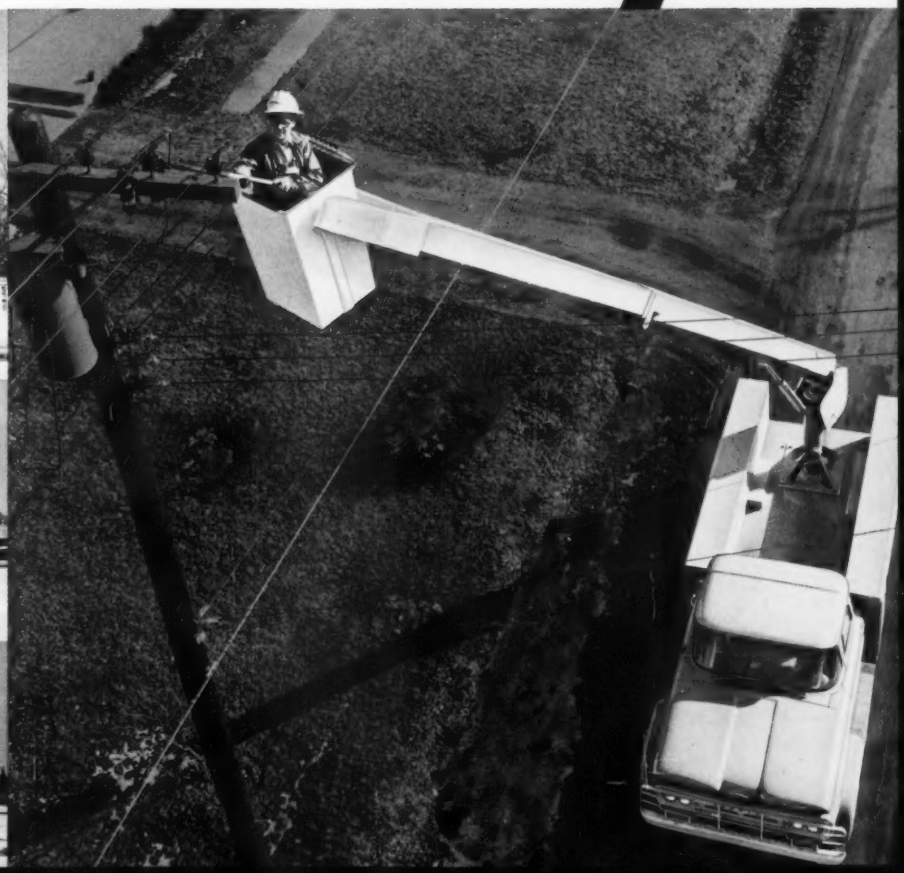
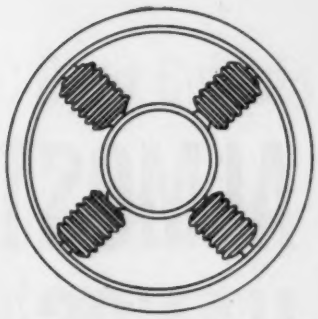
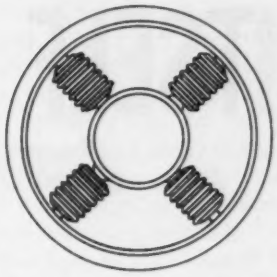
PITMAN MANUFACTURING (CANADA) LTD., TORONTO





Standard Bus—Up to 90°C The AIEE standard, coupled with I-T-E quality construction—lowest losses.



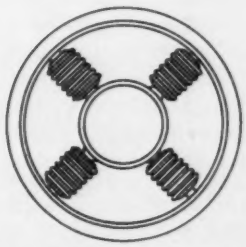
High Temperature Bus—105°C Reduces conductor size by 15% with correspondingly lower cost—but with increased losses.

Pick the bus that saves you the most

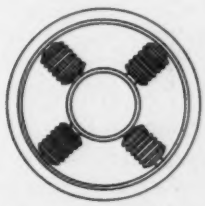
Only I-T-E Isolated Phase Bus is available in such a variety of designs to save you money. Your selection of the type of bus to buy depends on evaluation of both original cost and losses, plus careful consideration of the desired method of operation.

All I-T-E bus types are backed up by the engineering and laboratory experience of I-T-E. Design constants are so well known from theory and test that the most economical conductor to use for any ampere rating and voltage has been computer calculated.

Get full details on I-T-E Isolated Phase Bus. Write for Bulletin 2604-1A. I-T-E Circuit Breaker Company, Dept. SW, 1900 Hamilton Street, Philadelphia 30, Pa.



Forced-Air Cooled Bus Even smaller in size, with still lower material costs —still higher losses.



Liquid-Cooled Bus Minimum conductor size—highest losses.

I-T-E CIRCUIT BREAKER COMPANY

ALMOST HANGS ITSELF

S & C Open Cutouts take the "hit and miss" out of fuse tube handling

It's a cinch to hang the fuse tube in the Type XS open cutout. No fumbling, no missing, no dropping. Think how much easier and safer it makes the lineman's job, especially at night or during adverse weather. The operator's eye view at left shows why linemen like this cutout. There's nothing intricate about the hinge and how to approach it. Notice the wide and deep trunnion pockets in the ears of the hinge. The trunnions on the fuse tube drop in readily, without precise "steering."

Yet once the fuse tube is hung in the hinge it is positively kept from jamming or missing as it is swung closed. Multiple steering surfaces at the hinge and trunnion along with wide-angle upper contact guides give positive control. The tube can be slammed closed, blind.

Easy fuse tube installation is just one of many big advantages of S&C XS Open Cutouts. Here are more: 1) exhaust always goes down and away from operator and conductors because of single venting; 2) arc energy and exhaust violence are minimized by an "arc-shortening" device; 3) you get versatile, economical load switching with Loadbuster® (the portable loadbreak tool).

To get an idea of how the XS open cutout can give you system-wide protection and switching, please write S&C Electric Company, 4421 Ravenswood Avenue, Chicago 40, Illinois . . . and ask for Bulletin No. 511 "S&C Open Cutouts—Type XS."

S&C ELECTRIC COMPANY

S&C

The "slave-hands" of an AI technician handle radioactive materials through a hot cell window 3½ feet thick. *Woodcut by Edward Kysar.*

Let A.I.'s experience guide your Nuclear Power Program

The largest privately-owned facility in the world for remote handling of radioactive materials is located at Atomics International's 290-acre field laboratory near Los Angeles. Here the men who pioneered the creative peacetime uses of atomic energy are applying their 14 years of experience to developing advanced nuclear reactors and associated equipment.

Much of AI's work has been on projects for the U.S. Atomic Energy Commission. This includes the Organic Moderated Reactor Experiment at the National Reactor Testing Station in Idaho and the Sodium Reactor Experiment in California. AI has also built and is operating SNAP II, a 220-pound prototype reactor designed to produce 3 KW of electricity for space vehicles.

With some of the most sophisticated facilities in the world at their disposal, the men at AI are now conducting studies for large power station reactors in the United States and Europe. Two reactors are now actually under construction under AEC programs—an Organic Moderated Reactor in Piqua, Ohio, and a Sodium Graphite Reactor in Hallam, Nebraska. Smaller research reactors have been built by Atomics International for Denmark, Germany, Italy, Japan, Puerto Rico and several sites in the U.S.A.

For details contact: ATOMICS INTERNATIONAL, Canoga Park, California, U.S.A. Cable address: ATOMICS.

ATOMICS INTERNATIONAL
A DIVISION OF NORTH AMERICAN AVIATION, INC.
PIONEERS IN THE CREATIVE USE OF THE ATOM

Other offices in: Washington, D.C., U.S.A.; Geneva, Switzerland. Affiliated with: INTERATOM, Bensberg/Cologne, Federal Republic of Germany and DYNATOM, Paris, France.

COMPACT... ADAPTABLE... RELIABLE

New Westinghouse Isolated Phase Bus

Ever-increasing current and voltage ratings . . . maximum in compact arrangement . . . full adaptability to generating and distribution station layouts . . . complete reliability—these are the modern station demands met by new Westinghouse isolated phase bus. Here are the design features which assure long, trouble-free performance:

Single Insulator. Only one high-strength insulator is used at each bus support location. Deep grooves provide high dew withstand voltage. Resilient mounting reduces short circuit forces on the porcelain. All combine to provide maximum reliability of service.

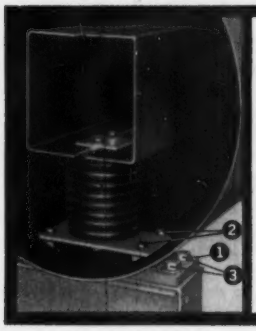
Main Conductor. Hollow square or tubular bus may be specified to suit application requirements.

Enclosure Construction. Enclosures are cylindrical; of heavy, heat-treated aluminum plate; rolled and seam-welded . . . assuring maximum strength against internal or external pressure and side stress. Enclosure tightness is assured.

Accessibility of Enclosures. Telescoping of enclosures simplifies inspection and maintenance of insulators and conductor joints. Adequate clearance facilitates telescoping and alignment. Longitudinal gaskets are eliminated. Circular, extruded, neoprene gaskets, retained by two-bolt clamping rings, make assembly easy and assure tight joints. Enclosure ends are not flanged. Small supporting feet reduce weight and provide smooth cylindrical exterior.

Coordinated Design. Westinghouse isolated phase bus is coordinated in design to assure long, economical service with minimum maintenance—and to reduce field assembly time by permitting large assembly shipments, limited only by shipping and handling facilities.

For complete facts, call your Westinghouse representative, or write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa. J-60998

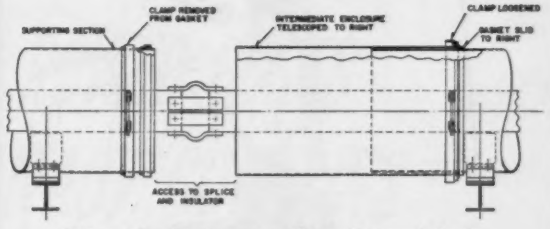


Only One Insulator Is Required at each main conductor and enclosure support location. Enclosure tightness is assured by these arrangements:

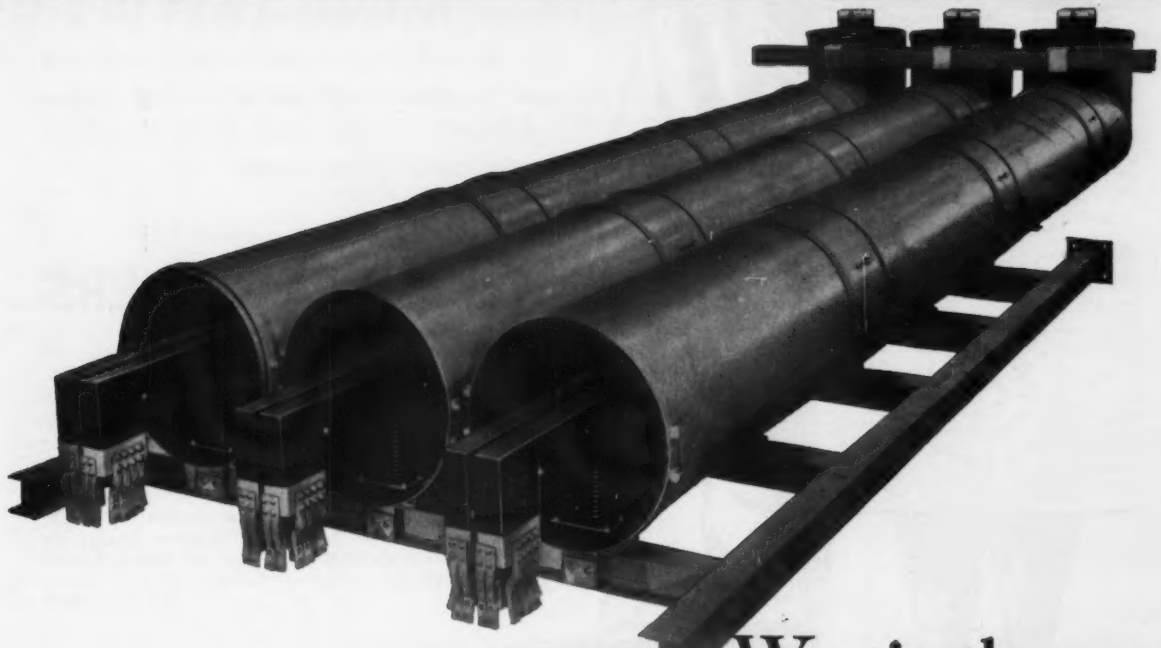
1 Welded-in support of high-strength extruded aluminum.

2 Resilient insulator mounting plate bolts dead-end in extruded support.

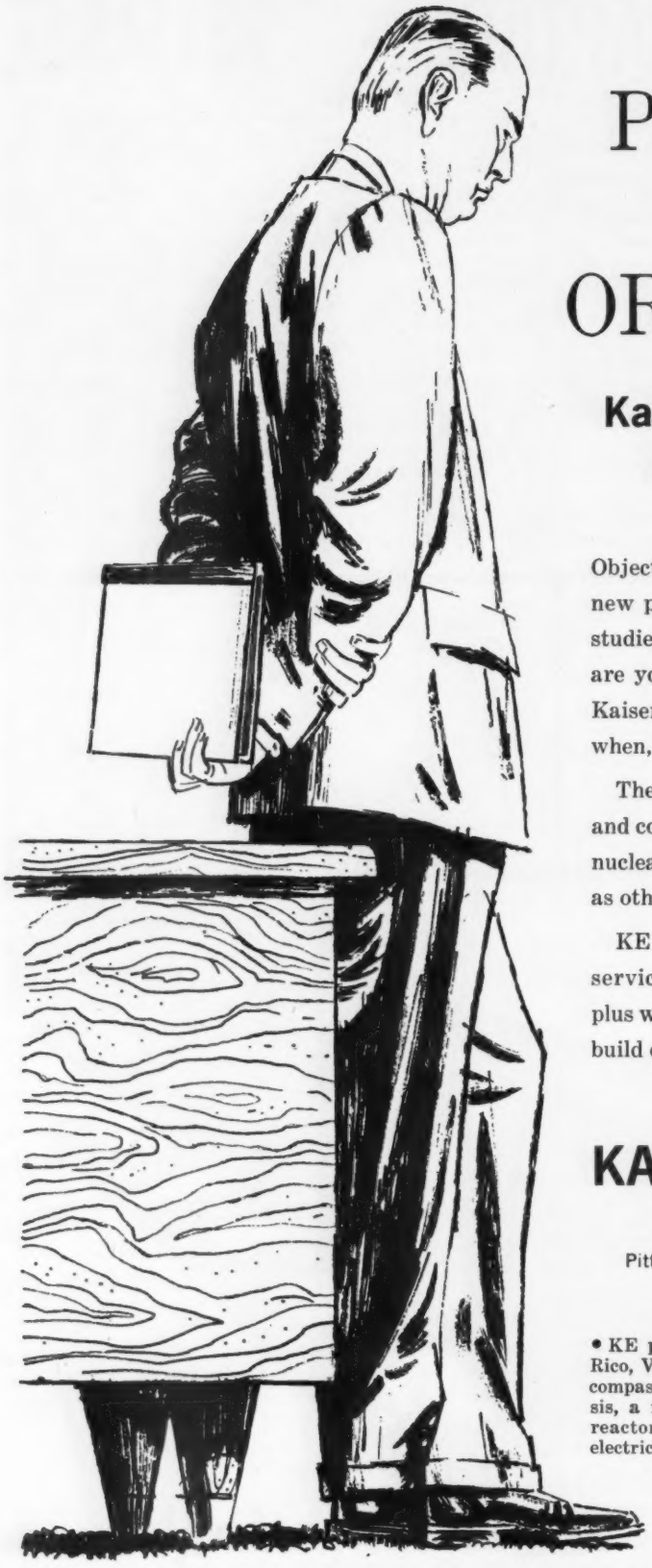
3 Assembly mounting bolts are external to the enclosure.



Telescoping Enclosure provides ready access to insulators and conductor joints for inspection or maintenance.



YOU CAN BE SURE... IF IT'S Westinghouse



PROCEED, DEFER OR MODIFY?

Kaiser Engineers can help you decide

Objective analysis is vital to sound decision on new power generating facilities. Feasibility studies, economic analyses and site evaluations are yours by an outside, impartial firm when Kaiser Engineers is selected to help you decide when, how and where to proceed.

These services are in addition to the design and construction of all types of power plants—nuclear, fossil fuel and hydro-electric—as well as other nuclear facilities.

KE offers complete, one-company, integrated service from concept through construction—plus world-wide experience and the ingenuity to build quickly, within budget.

KAISER ENGINEERS

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• KE projects include work in Ghana, Japan, Puerto Rico, Vietnam, as well as the United States. They encompass such diverse assignments as nuclear fuel analysis, a nuclear research center, plutonium production reactor, steam-electric power station and a hydro-electric plant.

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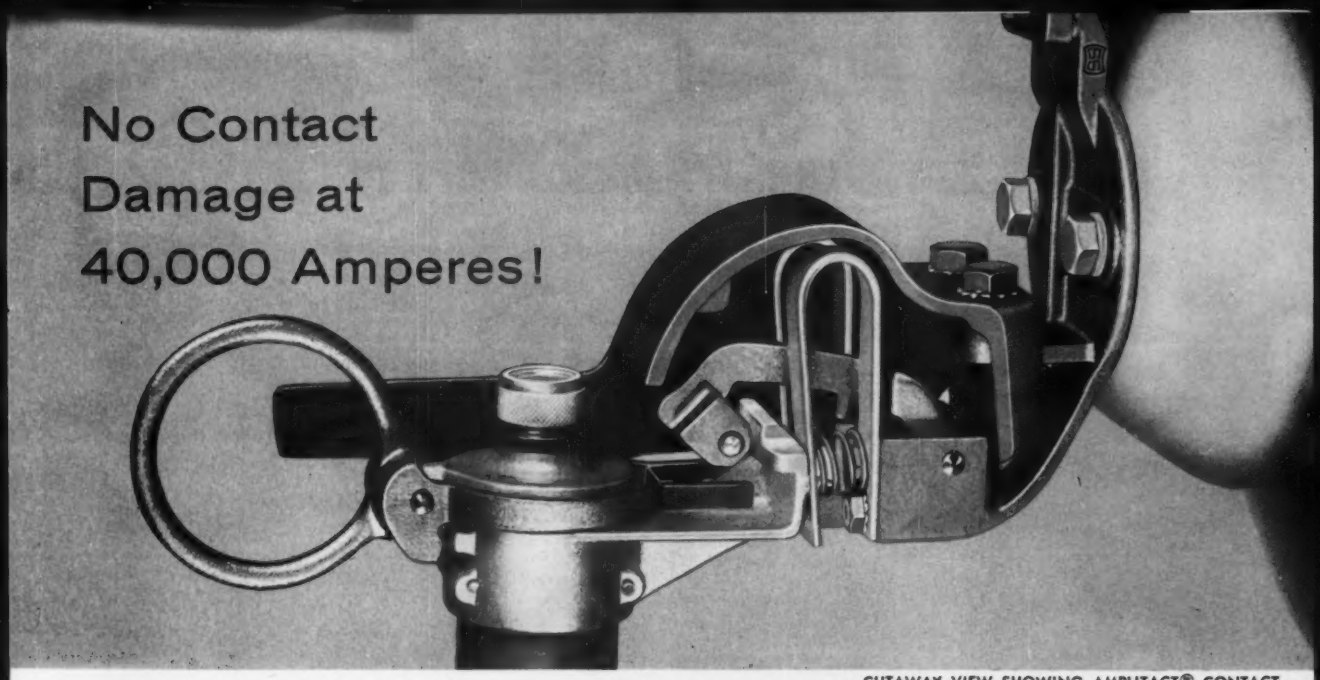


CUTAWAY VIEW SHOWING AMPLITACT® CONTACT

SOUTHERN STATES' POWER FUSES EMPLOY AMPLITACT® CONTACTS TO PREVENT CONTACT DAMAGE

Now, for the first time, "switch-proved" Amplitact® contacts are used on Southern States power fuses. Repeated tests at current ratings up to 40,000 amperes show no contact damage.

Used successfully for many years on Southern States air switches, Amplitact® contacts are now used on the new BPA and HPA Power Fuses.

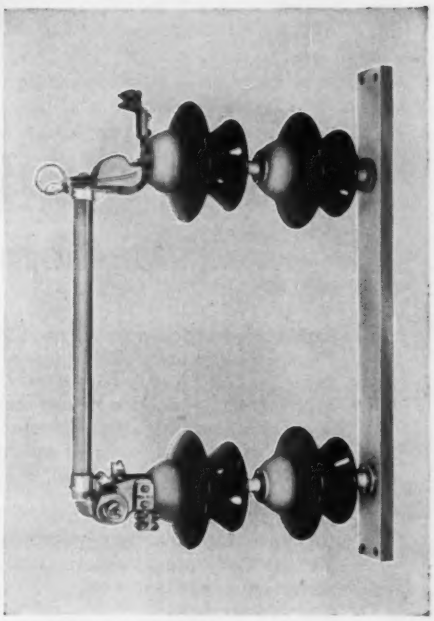
The Amplitact® harnesses electromagnetic forces generated on a high fault, increasing contact pressure when it is needed most.

While contact damage under extremely high fault currents has been more irksome than serious, the Amplitact® eliminates any possibility of damage.

These new power fuses have all of the outstanding advancements of the BP, MP, and HP power fuses introduced by Southern States in 1959—plus the reverse-loop contact. They have expendable cap fuse holders to provide dependable clearance of high or low current faults. Fuse holders are designed for easier handling and are equipped with a large operating eye. A stationary sleet shield gives better protection against icing and provides guidance when the fuse is slammed closed.

Low cost refusing in the field is accomplished with easy-to-use fuse kits.

Get your Southern States representative to give you full information about this important development in power fuses, or write direct for Bulletin 60 PF.



TYPE HPA POWER FUSE

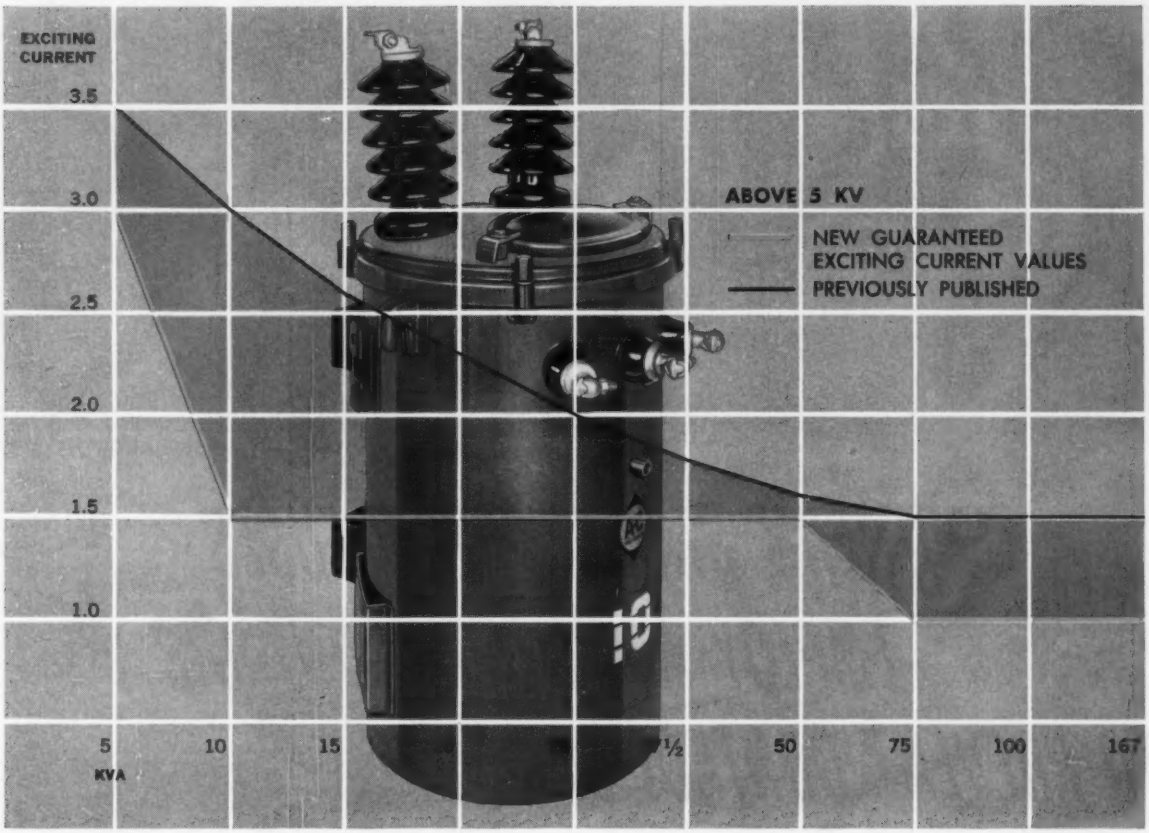
KEEP PACE ELECTRICALLY

IN CANADA
Dominion Cutout Co., Ltd., Toronto

SOUTHERN STATES
EQUIPMENT CORP.
HAMPTON, GEORGIA

ALLIS-CHALMERS

A-1254



Close the gap on revenue losses

with Allis-Chalmers distribution transformers

Exciting current cut as much as 50%! That's the dramatic Allis-Chalmers story proved by the curves above. Multiply this reduction by the number of similar distribution transformers on your system. **Then specify Allis-Chalmers . . . and profit these four ways:**

1. Generating capacity requirements are cut. Only minimum amounts of nonrevenue-producing exciting current are needed.

2. Lower exciting currents help reduce copper loss on your transmission lines.

3. Your system carries a higher amount of revenue-producing power.

4. You reduce the need for system power-factor corrective equipment.

These new exciting current values are *guaranteed* by Allis-Chalmers. They're available to you in all distribution transformers up to 167 kva . . . in all voltage classes. Allis-Chalmers extra revenue-getting power is a result of a continuing redesign program. Engineers team their ingenuity and skills with digital computers . . . rejecting and selecting new values to create the optimum in balanced transformer design.

For all the facts fast, contact your nearby A-C representative or write ***Allis-Chalmers,*** *Power Equipment Division, Milwaukee 1, Wisconsin.*

Industry's most rigid quality-control program assures you of top transformer performance.

The Antitrust Cases: 3–

Market Statesmanship

In the first two editorials of this series, we've attempted to place the current antitrust litigation against electrical equipment manufacturers in perspective, and to present some vital considerations we believe the courts should recognize in formulating final judgments.

In the final comment of this series, we'd like to look at the future.

The court judgments may well require a different pricing approach in many equipment lines than was in effect prior to the indictments. We hope the courts won't attempt to define the new pricing methods precisely, but they *are* likely to set forth certain restrictions.

The actual approach which will be established probably will evolve gradually over a formative span of time. Even while moving as close to a "free" market as possible, the pattern must provide generally stable and reasonably profitable prices. These two requirements by no means are mutually exclusive, but their interplay in application will mean a good deal of trial and error.

During this formative period, real responsibility lies equally on buyer and seller.

For the buyer, it means:

• Restraint from taking advantage of the transient situation to run prices below cost. This is especially important during construction cycle downswings, the period of greatest risk of price instability.

• Looking to the long-range interests of his company and his industry, in the full knowledge that he must have strong suppliers to continue the essential growth of both.

For the seller, it means:

• Exercising price judgment, based on properly allocated costs and reasonable profit margins, with a precision seldom heretofore required. This implies the application of more courage and willpower than in the past, and must be based on the rejection of the assumption that pricing chaos accompanies a relatively free market.

• Using price leverage in anticipation of, not in reaction to, demand fluctuations.

These requirements on buyer and seller add up to an overworked word: *statesmanship*. But it applies.

We have seen some extreme examples of the lack of statesmanship on both sides of the counter, with each side blaming the other for the results. But it takes two to strike a bargain. Both sides are equally responsible, and will have to show equal statesmanship.

Marketing and purchasing men have been seeking new stature in their industries and their companies. Here is the opportunity for them to earn it.

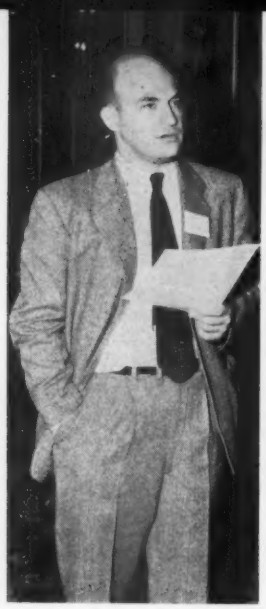
What else can be done to help? In many industrial markets, price levels, measured by recent average sales prices of selected typical commodities or products, are available in some form. We believe establishment of such data, on an impartial, legal and ethical basis, would provide rough guidelines which could aid buyer and seller alike. We would like to see such a service instituted.

Possible increased emphasis on the U. S. electrical equipment market by foreign manufacturers must be taken into consideration in any evaluation of altered pricing philosophies. But we can see nothing in the effects of the antitrust suits which *of itself* would increase this emphasis. If anything, possibly lower domestic price levels, resulting from any new pricing patterns, will tend to delay foreign intrusions into the market.

We believe the overall situation presents the opportunity to clean out practices which the courts may consider improper, and to establish a new, successful pattern that will benefit buyer and seller.

If the courts are unexpectedly severe, and if all concerned retreat into an insular shell of unenlightened selfish self-interest, we foresee trouble.

But the electrical industry, manufacturers and utilities, is a healthy, vigorous one. We have every faith that it will ride over this bump in the course of events more healthy and vigorous than ever.



RADIN AND RAVER (l and r) give reports

Regional Systems

- American Public Power Assn interest seems to be shifting from emphasis on generation to regional interconnections and to large transmission systems

- Investor companies' plan on Upper Colorado appears doomed according to Seaton

Public power advocates are shifting their emphasis from federal generation to large transmission systems and regional interconnections as a means of achieving their long-term goals of "abundant, low-cost power."

Generation Is Still Important

However, this is not to be taken to mean that they will ignore generation. They are still very much interested in pushing the river basin hydro development, and in federal, or at least public, development of the atom.

The shift appears to be the principal theme running through the speechs, off-the-record remarks, and corridor conversations at the American Public Power Assn's 17th Annual Convention, held in Washington last week.

The idea of tying small municipal systems together through large federal or common carrier transmission grids as a means of obtaining operating economies was touched upon by speakers in general sessions, special workshops and interviews.

APPA Gen Mgr Alex Radin cited six "encouraging examples of progress" during 1959 toward setting up joint power supplies for public power systems:

(1) An Illinois Supreme Court ruling that Springfield and Jacksonville municipals could build a transmission tie line between their systems.

(2) Plans by 14 southeast Missouri and Illinois municipals to interconnect their operations, with an added tie, via Missouri-Arkansas electric power co-op, to the Southwestern Power Administration.

(3) Plans by two groups of Ohio municipals to interconnect their operations: Cleveland, Orrville, Painesville and Norwalk, Shelbyville, Oberlin.

(4) Expanded power supplies will be made available to Iowa co-ops and municipals through construction of new federal transmission lines.

(5) Municipals and co-ops in Arizona, Colorado, New Mexico, Utah and Wyoming have joined in a new organization to obtain power from the federal Upper Colorado River Project.

(6) Completion of the St. Lawrence project and construction of the Niagara project point toward new, "lower cost" power supplies.

Radin Wants Federal CRSP Lines

Radin urged federal funds to build a federal transmission system for the Upper Colorado dams, construction of a federal transmission line between California and the Bonneville Power Administration, approval of the Passamaquoddy Tidal Power Project, and an FPC license for the Nez Perce hydro power project to be built by Washington Public Power Supply System.

Radin gave the convention a glowing report of its growth in members and finances during 1959, pointing out that "the average public power consumer used 49% more power during 1958 than the private power consumer, yet his annual bill was $7.39 less . . ." He added that, "although there are in-

TVA AND NORTHWEST cited by Hays and Mrs Neuberger as examples of public power effectiveness and also as opportunities for even more activity

Are in Goals of Public Power Group

stances where local public agencies have entered into satisfactory wholesale power contracts with private power companies, in a large majority of cases the power companies have not given the municipal systems a truly wholesale rate."

Interior Secretary Fred Seaton told the convention "it is highly unlikely" that any non-federal group would be able to provide a backbone transmission system for the Upper Colorado project. He said he doubted if such a non-federal organization would meet the necessary principles, and particularly the requirements of the project.

Seaton promised to make a final decision on the matter "promptly," pointing out that his office had just received recommendations on the transmission lines from the Bureau of Reclamation.

Seaton pointed to 33-million kw of non-federal power projects applied for at the Federal Power Commission since the Eisenhower Administration came into office—an all-time record.

Raver Talks on Cost Comparison

Dr Paul J. Raver, APPA president and Seattle city light superintendent, charged that "public power is a public business—because the power industry itself is a public business, whether it is owned and operated by a public agency or a private agency . . . it is safe to say that if there were no local public power, all or most American consumers would be paying far more for their electricity and using far less of it than they are today . . .

"The fact that the power industry is vested with a public interest means that a private power corporation has no inherent right to serve a community, that it engages in the business only by permission of the public, and that the people reserve the right to provide themselves with electricity through their public agencies wherever and whenever they choose." He added, "this concept means competition for the privately owned utilities. Because they dislike this, and would prefer an undisturbed and nation-wide monopoly status, with complete control over the resources as well as the markets, the private power companies have unleashed a great propaganda drive to undermine this basic principle in the minds of the public, our legislators and our own local boards of directors."

Maurine Neuberger, widow of the late Sen Richard Neuberger (D-Ore.), told the APPA convention in Washington last week that the Pacific Northwest needs a "systematic plan for future development of water resources." She renewed the plea for the proposed federal Bonneville Power Corp and agreement with Canada for power development of the Canadian Columbia.

"If Russia taps the Yenesei while we fritter away the Snake, who is at fault except ourselves?" she asked.

Brooks Hays, TVA director, told the convention that "public ownership is a good, a necessary part of the electric industry; it provides a yeast of comparative competition in a field where natural monopoly could easily lead to a kind of complacent inertia. But public ownership is not enough . . . public service is a more meaningful phrase than public ownership . . . in leading the way to lower rates, in rural electrification, publicly owned systems have acted as a goad to the industry. They should continue to do so. But it will require constant effort on those in charge of publicly owned operations. It will call for the greatest ideals of public service."

Northcutt Ely, member of Ely, McCarty and Duncan, Washington law firm, hit plans to tax municipal systems on the same basis as private utilities. "Without the public power delegated by the state, the utility, whether privately or public owned, is as useless as a dead transformer," he said. "The public, when it owns and operates its public utilities, is reoccupying a field that always belonged to it. If it does occupy the field, the revenues realized from this public service are not constitutionally subject to federal taxation . . . by hypothesis, these utility revenues can be applied only to public functions, and cannot be taxed by another sovereign if doing so would impair those functions."

Paul Fahey, TVA purchasing agent, defended the Authority's purchase of foreign-made equipment. And he took the opportunity to blast "identical bids" received by TVA for various electrical equipment invitations. He emphasized that foreign-made equipment is as good as U.S. items, and cheaper.

Labor Leader Blasts Companies

President Paul Phillips of the United Papermakers and Paperworkers, blasted private power as "predatory opposition" to labor's stand on power supply. "As long as any part of the electric industry is privately owned, the only dependable means of forcing it to function in a reasonably satisfactory manner is with the yardstick," he charged.

"Regulation of monopoly is not enough," he added. He criticized the FPC and state regulatory commissions for failure to do an adequate job, adding, "regulation cannot give us low-cost power because low-cost power is the product of creative intelligence and desire."

Phillips also attacked: (1) the proposed "downstream benefit" bill in Congress (HR 5309), (2) "tax gimmicks and tax free dividends" used by private utilities, (3) failure to develop the Potomac River, including power generation. He added, "the worst thing about private power is that it corrupts everything in sight . . ."

FRED SEATON CASTS DOUBT on acceptance of CRSP private plan

Senate Battle Foreseen On FPC Confirmations

President Eisenhower last week followed up a curt announcement that he wouldn't reappoint Federal Power Commissioner William R. Connole with the nomination of Thomas J. Donegan, 53, a member of the Subversive Activities Control Board, to replace him.

The President also nominated Paul A. Sweeney, 65, a lawyer with lengthy government service, to the remaining three years of the term of the late John B. Hussey of Louisiana.

Coming on the heels of the decision on Connole, the two appointments appeared headed for certain trouble in the Senate, where confirmation is required.

Donegan, a political independent, was with the FBI from 1933 to 1946, and was named to the Subversive Activities Control Board in 1957. Sweeney, a Democrat, has been with the Justice Department since 1933, and is first assistant in the Office of Legal Counsel.

Controversy on Connole

It is generally acknowledged, however, that the merits of Donegan and Sweeney are incidental to the issue raised by Eisenhower's turning his back on Connole, his own appointee, and one who has built a reputation as a champion of the consumer.

Any hope of the Administration that the appointments would be non-controversial faded as Senate Democrats from natural gas consuming states stepped up their demand for an explanation of Connole's replacement.

Sen William Proxmire of Wisconsin and Sen Thomas J. Dodd of Connecticut, Connole's home state, carried the issue to the Senate floor, and announced plans to keep up the fight.

Dodd called Connole "the strongest man on behalf of the consumer" on the FPC, and asked "what mysterious force" prompted dropping him.

Proxmire, angered by Eisenhower's statement that "I just think I can get a better man" than Connole, asked:

"Better for whom? For the consumers—I doubt it. For the big oil and gas boys—you bet your life."

Donegan Caught Between

Proxmire asked the Senate to "carefully scrutinize" Connole's successor, raising the chance of quick confirmation of Sweeney, with the main fight waged over Donegan.

However, the brief time remaining before Congress adjourns for the summer, plus election year politics, adds another dimension to the battle.

Politicians are discussing the possibility that by bottling up both nominations in the Senate, the Democrats, if they elect a president in November, would be in a position to name three of the five commissioners early in 1961.

If the Senate fails to confirm Donegan and Sweeney, the new president could name replacements, and could also replace Commissioner Arthur Kline, a Republican, when his term expires June 22, 1961.

Sweeney can take office as soon as he is confirmed, and Donegan, after confirmation, when Connole's term expires June 22.

Failure of the Senate to confirm them could leave the FPC, now operating with four members, shorthanded for a longer period, but in such a situation Eisenhower would give them interim appointments after Congress adjourns.

The heat generated by Connole's ousting is also expected to extend to the House, where the Legislative Oversight Subcommittee hearings on the FPC are to begin May 10.

The House is investigating charges of influence-peddling in FPC gas cases, but Eisenhower's treatment of Connole is sure to spur on the commission's critics there.

If the House hearings explode with new charges developed by subcommittee investigators, industry men are wondering whether the Administration will be able to keep

DONEGAN

Jerome K. Kuykendall, a Republican and a favorite target of FPC critics, as commission chairman.

With the furor over the FPC continuing on several fronts, therefore, Donegan and Sweeney are in the roles of by-standers.

The only question being asked by industry representatives thus far is whether they have the background.

No Regulation Records

There is no information available in Washington, to date, to indicate how the new men regard the two or three major electric issues now before the commission. Neither has been available for interviews as to his attitude toward the big controversy of development of the Snake River, by private or public effort; nor has either a public position on rate-making, allowability or private utility advertising on political issues, and the like.

When Donegan and Sweeney were named, the White House acknowledged that previously consideration has been given to whether appointees would be oriented in favor of consumers or industry.

Eisenhower was described as determined to halt this practice, and this presumably accounts for the choice of neutral backgrounds.

Ironically, however, when the Senate debates the qualifications of Donegan and Sweeney, their noncontroversial backgrounds may be described as a lack of experience in regulation or industry—particularly if Senate Democrats are anxious to block their confirmations.

Russia Proposes Joint Fuel Use

MOSCOW (*McGraw-Hill World News*)—The Soviet Union has proposed joint exploitations of fuel and power resources among the nations of Eastern and Western Europe.

The offer was made last week at the Geneva meeting of the United Nations Economic Commission for Europe by Nikolai Firyubin, deputy minister of foreign affairs for the USSR. The UN meeting was held for the purpose of trying to set up a trans-Atlantic economic organization between the Western Hemisphere and Europe.

The Russian move is viewed by some as an attempt to head-off the formation of such an organization, and at the same time, strengthen economic ties between the Soviet Union and Europe.

Firyubin's remarks were an expansion of an article in the Soviet publication *Promyshlenno Ekonomisheskaya Gazeta* which said ". . . of urgent importance to the European countries is the question of joint exploitation of fuel resources, and the setting up of an organization for the rational exchange of different types of fuel with the aim of lowering the fuel deficit in Europe." The article noted the 1958 opinion of European power experts that in the next few decades Europe would constantly experience difficulties with its fuel supply, particularly liquid and gaseous.

Fuel Discoveries Change Outlook

"However," the article went on to say, "new power-resources deposits have been located on the Continent which offer a basis for the settlement of these problems." Firyubin said that coal supplies are evenly distributed in Europe, but "the picture is different with regard to oil and gas. Under these conditions it would be quite natural for the European countries to unite their efforts."

He pointed to rising Soviet oil exports and a projected Soviet oil pipeline to Eastern Europe, and said that the potentialities of such a plan were not exhausted. In this connection, Firyubin proposed the creation of a permanent commission to deal with the oil situation. This commission would study oil trends and developments, including those having to do with refining, marketing and other questions. It would also look to the "creation of a European network of oil pipelines."

The Soviet minister said that it is time to begin the study of all European power resources on the Continent, including hydro power.

He said Europe's economy would benefit greatly by all-European cooperation in design and construction of big hydro and thermal stations in "countries possessing reliable fuel bases with the transmission of electric power to those countries in which there are fuel shortages." Firyubin called for more cooperation in designing and building all-European high-voltage grids. "Up to this point, no one has ever raised the question of technical and economic cooperation among the peoples of the whole Continent. Now these questions are being raised by life itself." He said the Soviet Union was firmly convinced that the promotion and development of world trade need not be sought along the lines of splitting the world into separate trade blocks.

Joint Hydro Project Planned

In another development, reported by McGraw-Hill World News from Zurich, Switzerland, Norway and the Soviet Union have announced agreement for power development projects to be build in the Pasnik River separating the two countries.

According to the agreement, the Norwegian firm "Norelectro" will build a complete hydro station on the Pasnik, supplying all equipment except turbines and generators. These will be made in the USSR by "Technopromexport."

The agreement further allows for the eventual construction of three hydro stations on the river, one of which will be owned by Norway and the other two by the Soviet Union. No information concerning the capacity or completion dates of the plants has been made available.

Harnessing a China Dragon

For centuries China's Yellow River has been like a wild, deadly dragon, killing millions with its raging floods.

Here in Sanmen Gorge, a huge dam is under construction as part of a 50-year program to bring the river under control. Beside flood control, the dam will have generating facilities for more than 1-million kw.

CITY INCINERATOR is civic benefit

Benefits Accruing From

Commenting on the experiences since sale of electrical facilities to a private utility, one long-time resident of Berea, Ohio, says: "It seems to me that subsequent administrations have been glad to be relieved of that whole group of problems connected with running a light plant."

Is a small but growing community better off selling its municipal lighting system? The answer in a specific case would be influenced by the circumstances involved, of course. But, perhaps the ramifications of the big picture—the whole question of municipal ownership can best be seen in a small example.

Berea, Ohio, is a good test case since it is an extreme example in many ways. Ten years ago, the issue of whether or not to sell its light plant to the Cleveland Electric Illuminating Co caused one of the ". . . bitterest controversies ever to split the community into opposing camps," according to the local newspaper, the *Berea News*.

The facts show that the community has done very well, indeed, through the sale of its light plant.

To understand the bitter controversy over the sale of Berea's lighting system ten years ago, it is necessary to separate the facts and economics of the situation from the feelings of the people in the community.

Berea, home of Baldwin-Wallace College, has a highly developed sense of community identification. It has shared in the prosperity of large neighboring communities without losing its basic character of a small college town. That despite the fact that it is on Cleveland's near suburban west side.

CAPITAL FUNDS WERE USED for a new building for city's police department

The light plant was "part" of the old town and, like an old automobile which is really more bother and expense than it is worth, was considered worth keeping by the old time residents simply because it did belong to the old town. Illustrating the "family" attitude taken toward the light plant is the fact that the city was supposed to pay for street lighting but somehow never seemed to get around to doing it.

Population Doubles—Troubles

Trouble developed, however, when Berea doubled its population between 1940 and 1950 to a total of about 12,000. The newcomers had no personal identification with the old light plant and considered it ridiculous to spend money required to keep capacity up with current demands. The point was finally reached where a major decision to spend a lot of money to repair the system had to be made.

"Trade the old buggy in and get something new," cried the newcomers. "Traitors," replied the old timers, feeling someone was trying to put something over on them because they didn't even recognize the faces of these newcomers who were yelling "sell."

Such are the reasons why you can still hear an old timer Berean mutter "we shouldn't have sold," and why, even today, no responsible city official in Berea will be quoted on the efficacy of the light plant sale.

Since the light plant was a capital improvement of the city, it was de-

System Sale

A NEW CITY LIBRARY was purchased with funds from sale of the electrical system

cided that funds from its sale should be used only for capital improvements. The sale price was $805,000, and payment of bonds due and expenses cut the amount to $691,114.

With this fund, the city has purchased the property sites ($79,838) and constructed ($362,620) a new police station, a new library, a new incinerator, and a new community swimming pool. The city also has purchased and improved property for city parking lots, made improvements on its downtown triangle, improved its city hall, installed a new water plant heater unit and invested some of the fund in a sidewalk revolving fund. As of Jan. 1, 1957, the city still had $248,656 in cash and securities in the light plant sale fund.

Utility Pays Real Estate Taxes

In addition to the original purchase price, CEI paid Berea $35,470 in real estate taxes between 1950 and 1956. Since then CEI has paid $9,508.98 in 1957; $11,045.27 in 1958; and $13,219.37 in 1959 in real estate taxes.

During the same period the company paid $25,821.81 in 1957; $31,918.96 in 1958; and $38,283.31 in 1959 to Berea for municipal purposes and schools.

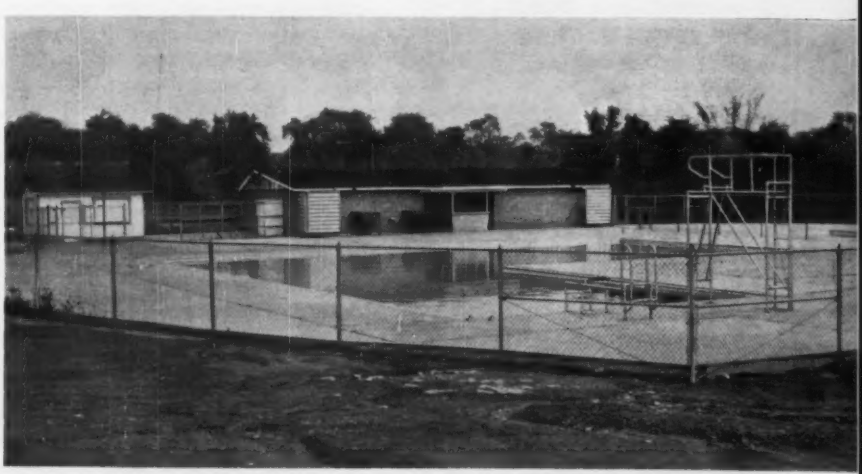
At the time of the purchase in 1951, Elmer Lindseth, CEI president, said: "We plan to invest about a quarter million dollars in the near future for additional facilities to serve Berea, and we shall further expand our facilities as required to meet the community's future needs." To date, the utility has invested $489,494 for rebuilding the system.

When CEI bought the system, it had 3,013 customers of all types. In 1960, there are 4,500 Berea residential customers alone. The service has been very good over the past ten years, an improvement over the municipal operation.

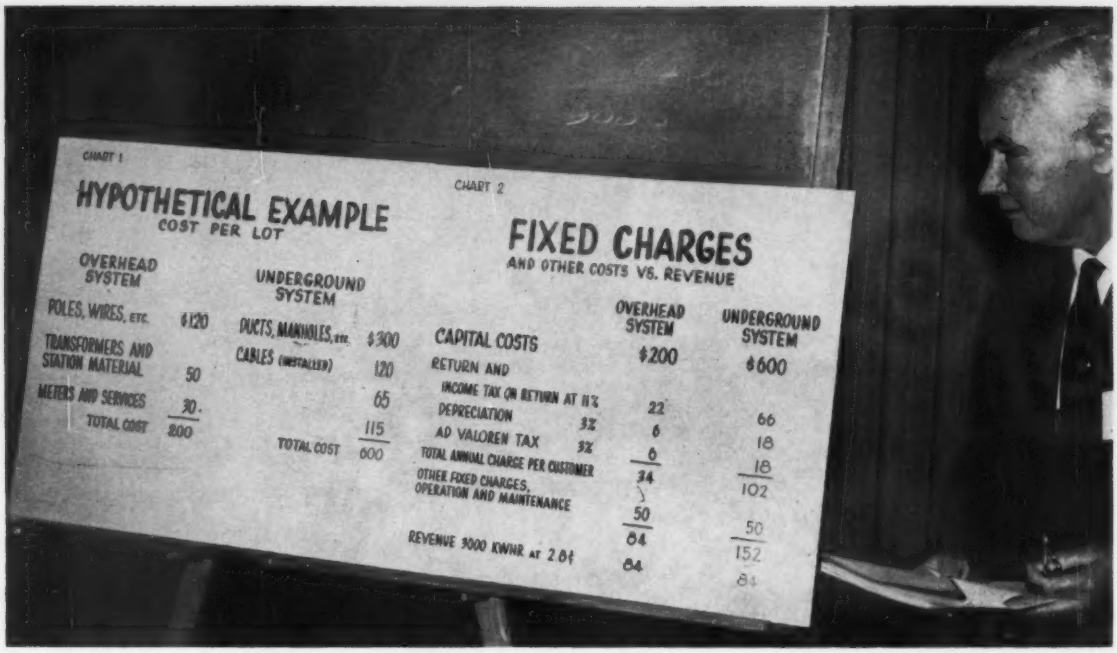
Experience of the past ten years has shown a rate advantage, too. In 1949, the last full year of Berea operation of the system, the average monthly use per residential customer was about 140 kwhr. The city's rate in 1949 for 140 kwhr was $4.94 compared with the CEI rate at that time of $4.25. In 1959, the average CEI residential customer average use was approximately 280 kwhr per month. Based on the former Berea rate, the charge for 280 kwhr would be $8.93. The CEI present charge for 280 kwhr would be $7.85.

The indicated saving of $1.08 per month is without allowance for a probable higher present rate for the city-owned system, and the street lighting bill is paid.

There will probably be a few old timers in Berea who will never admit the sale of the municipal light system was a good move. But each year their number becomes smaller and —ten years later—all of the force has gone out of their arguments anyway.



SWIMMING POOL IS PAID FOR, and is a revenue producer as are parking lots



H. G. DILLIN, San Diego G&E executive vice president, shows the financial facts concerning underground service to residential areas. He was lead-off speaker at California meeting of Pacific Coast utility engineers and operating men

PCEA Speaker Cites U/G Benefits

San Diego's H. G. Dillin gives E&O Berkeley meeting the pros and cons of underground residential distribution

Management would like to promote underground residential service although some situations could mean a loss to the utility, H. G. Dillin, San Diego G&E Co, told the Pacific Coast Electrical Association engineering and operating section recently at Berkeley, Calif.

Management wants an underground system which will provide satisfactory service at reasonable rates without undue discrimination. This means a system reasonably secure from extensive outages, where necessary maintenance is not unduly difficult and flexibility is sufficient to meet present and future demands.

Would End Objections

To the extent these objectives can be accomplished, said Dillin, management should have no concern in meeting growing demands for a system which will eliminate aesthetic objections to overhead lines.

Either 480/832-v wye secondaries or 12-kv delta primaries are more economical for residential underground than 4-kv, all costs considered, said R. C. Blankenburg, Southern California Edison Co. He cited a study showing that 4 kv is the least attractive.

Transformer spacing for best economy with vault-type construction varies from 8 to 24 lots per transformer, said Blankenburg. The best choice is influenced by load density and primary voltage.

As developers put pressure on utilities to provide underground residential service, utilities must depart from established practices to make underground systems economically competitive, said J. B. McKee, Wagner Electric Corp. Conductors can be buried directly in the ground, service boxes or pedestals can replace manholes or handholes, and the trench can be shared with a telephone company. The new pad-mounted transformer is most economical, he said.

Polyethylene-insulated cables are by far the lowest-cost, unshielded, non-metallic-sheathed type of cable available in the 5-kv range, said R. C. Graham, Rome Cable Division of Alcoa. PILC in the 5-kv range appears to be about 5% cheaper than shielded polyethylene. But this differential could well be eliminated in the final installed cost as lighter weight, manual splicing and terminating methods favor polyethylene.

Covering Offsets Metal

At today's relative metal prices for copper and aluminum, only polyethylene-insulated cables reflect any savings by incorporation of the equivalent-size aluminum conductor. In other cables, the increased cost of covering more than offset the metal savings, said Graham.

By automatic cataloging and analysis of outage information, Southern California Edison Co will be able to apply the principles of quality control to distribution service said M. R. Mosquini and J. A. Lighthipe. Circuit interruptions are reported on forms coded so that

(*Continued on page* 69)

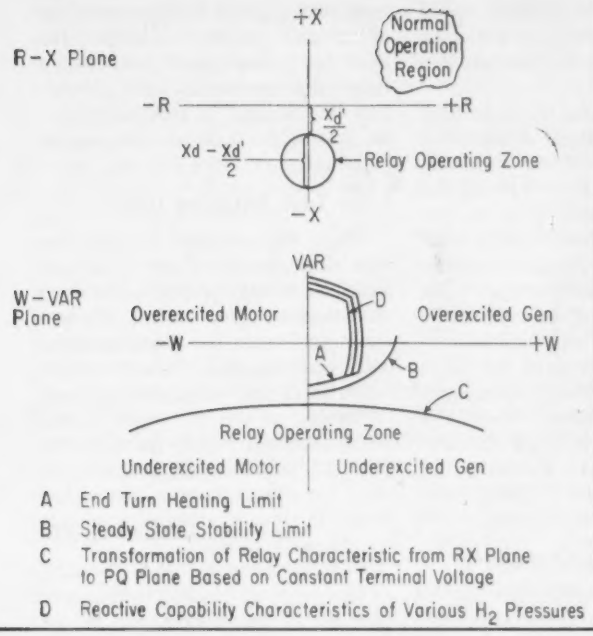


FIG 1. MODERN LOSS-OF-EXCITATION relays protect 120-Mw cross-compound generators at Oak Creek

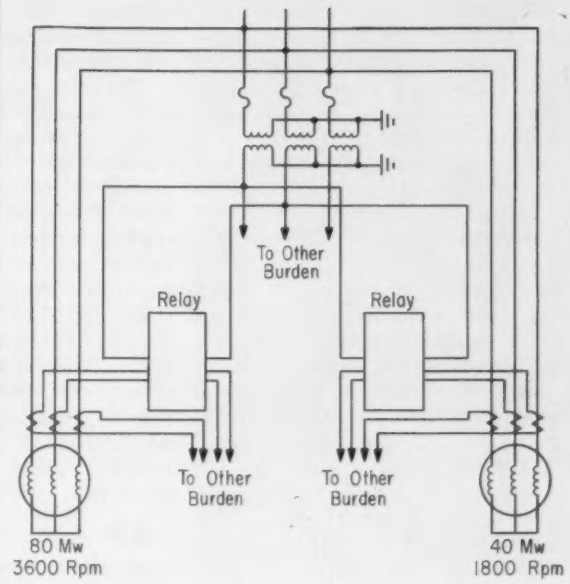


FIG 2. ORIGINAL CONNECTIONS for loss-of-excitation relays are shown. Relays went in service January, 1954

Studies Show Need for Better Generator Control on Large Units

J. M. FLEISSNER, Senior Relay Engineer, Wisconsin Electric Power Co, Milwaukee, Wis.

Satisfactory coordination between loss-of-excitation relaying, automatic field changeover, and high speed voltage regulation may be facilitated by digital computer programs currently under development. These high speed programs are expected to simplify an existing ac network calculator method—at present too tedious to be practical—for investigating the field changeover aspects of coordination.

Use of an undervoltage relay to initiate the automatic changeover is complicated by the rapid response of modern regulators. In some cases, the reduction in voltage may be long enough to trip the normal excitation but too brief to energize the emergency source.

The need for more easily applied analytical methods and a more thorough knowledge of the effect of excitation loss on system stability and voltage is illustrated by Wisconsin Electric Power Co's experience with the 120-Mw cross-compound machines at the Oak Creek Power Plant.

Wisconsin Electric Power Co's experience with loss-of-excitation relaying began in 1951, when Oak Creek was being designed. At that time studies were made to evaluate the probability of loss of excitation against the possible consequences.

Because of the severe effects of loss of excitation, excitation circuits on this system have always been designed for maximum reliability. On all large units, a dc undervoltage relay across the field initiates automatic changeover to an emergency excitation source.

Although the relay setting cannot be made too sensitive—since the voltage across the field varies during normal operation — the scheme had given good results in the past. In several cases of lost excitation, changeover was completed before synchronism was lost. However, experiences in 1954 and 1955 indicate that this scheme alone is not satisfactory for all types of excitation failure.

Even if the limitations on the method of initiating changeover were overcome, loss of excitation due to failure of the machine field would still be a problem. To provide protection for all excitation conditions, the changeover scheme would have to be supplemented by additional relay protection.

Our aim was to retain the advantages of the existing changeover scheme and gain the advantages of the new loss-of-excitation relays developed in recent years. Incorporating these features on the same unit, particularly a large one with modern voltage regulation, presented problems.

Loss-of-excitation protection was incorporated in the new 120-Mw generators along with the established system of excitation changeover and automatic voltage regulators. Operating performance of

these devices, the generators, and the system were then watched carefully, particularly under emergency conditions, to determine if improvements could be made. Relay and breaker operations, or failures to operate, and their effect on the generators and the system during system disturbances were also studied.

These cross-compound machines are made up of an 80-Mw high speed unit and a 40-Mw low speed unit, both with automatic voltage regulators. Normal excitation for each machine is taken from two exciters connected to the low speed unit shaft. Automatic throwover to an emergency, motor driven, high inertia exciter is provided.

The two machines are solidly connected by isolated phase bus. Each unit is connected to the 138-kv system through a 145-Mva transformer and one 138-kv breaker. Four such units are now installed at Oak Creek. The most practical method of excitation loss protection was to apply a loss-of-excitation relay to each high and low speed element. Characteristics of the relay used are shown in Fig 1; relay connections in Fig 2.

Loss-of-excitation relays for the first unit were placed in service on January, 1954. System connections in the area at that time are indicated by the solid lines in Fig 3.

• In September, 1954, a 3-phase fault occurred on the 26.4-kv bus at the Kenosha Substation and was properly cleared by overcurrent relays on the 26.4-kv transformer breaker. When the fault occurred, Unit 1 was isolated by the loss-of-excitation relays on the high speed element. There were no visual or graphic indications of a serious system disturbance.

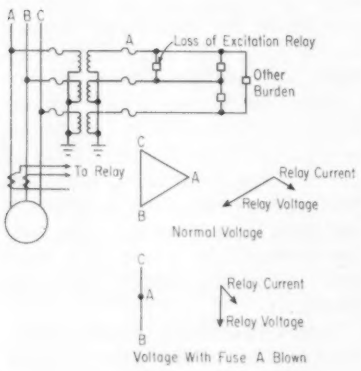


FIG 4. VOLTAGE COILS on loss-of-excitation relay were as shown when fuse "A" blew, isolating Unit No. 1

The voltage regulators at the time were operating without a minimum excitation setting. When the fault occurred, the regulator boosted the voltage in an attempt to assist stability. After the fault was cleared, the new regulator setting resulted in higher than normal voltage. The regulator then tried to reduce the voltage as quickly as possible and, because of the absence of the minimum excitation setting, apparently reduced the excitation below the pull-out level on at least the low speed machine. As a result, the machine entered the tripping zone of the relay and was isolated.

Test for Automatic Changeover

To determine whether the operation was due to a failure in the automatic changeover scheme, tests were conducted at approximately the same time of day and under system conditions similar to those at the time of the fault. During this test, loss-of-excitation relays were connected to an alarm point. Tests were initiated by opening the shaft exciter breaker on the high pressure unit.

When this breaker was opened, power oscillations began on the system before the emergency exciter closed. It was evident that the machine was losing synchronism. Attempts to restore excitation manually were unsuccessful and the 138-kv system split.

This operation was interpreted in the following manner. When the shaft exciter breaker opened, a discharge resistor was automatically connected across the field, causing the field voltage to decay at a slower rate than that expected for other types of field failure. As a result, the machine lost synchronism before the field under-voltage relay could drop out and initiate the closing of the emergency excitation breaker. The loss-of-excitation relay on the high speed element operated to sound an alarm, indicating that the relay was attempting to function. After this operation, the relays were again connected to trip the unit.

• In October, 1954, during a lightning storm, the 13.2-kv system fed from Lakeside power plant faulted at point "B," Fig 3. The fault was isolated by the operation of circuit breakers. When the line was re-energized one minute later, the fault was still present. The line breaker at Lakeside failed to clear the fault at this time, due to a defective auxiliary contact.

Relay Trips Swinging Unit

While the operator at Lakeside was isolating the faulted section, the Oak Creek operator observed violent swinging on Unit 1. He was about to isolate the machine manually when the loss-of-excitation relay tripped the unit. The voltage regulator was out of service at this time. Although it was questionable that the unit actually lost excitation, the operation was considered desirable since it avoided a serious system disturbance.

• On October 7, 1954, the fuse on the potential circuits to the loss-of-excitation relay blew, for an undetermined reason, actuating the 80-Mw element's loss-of-excitation relay and isolating Unit 1. At that time voltage coils of the relay were connected as shown in Fig 4.

When the potential fuse at "A" blew, the magnitude and phase of the voltage fed back to the high pressure loss-of-excitation relay through the other burdens were such that it appeared to relay as a true loss-of-excitation condition. To avoid a recurrence of this trouble, separate potential circuits to the relays have been installed. After this outage, two automatic oscillographs were installed to record ac and dc machine data.

• On January 9, 1955, after Oak Creek Unit 2 was installed, a fault occurred on a 26.4-kv line at Point "C," Fig 3. While the fault was being properly cleared by its line breaker, Oak Creek Unit 2 was isolated by the loss-of-excitation relay of the low-speed generator and excitation for the low-speed generator of Unit 1 was automatically transferred to the emergency supply.

Unfortunately, the oscillographs did not operate, so a complete record of generator response was not available. Voltage charts and visual inspections by the operators did not indicate that the system was in serious distress. Although the relay tripping zone was being entered, the desirability of isolating the unit instantaneously was questioned. On the premise that the relay was op-

erating on minor swings, the relay connections were modified as shown in Fig 5. The scheme would now operate in the following manner:

1. Operation of the loss-of-excitation relay alone would sound an alarm;

2. Operation of the loss-of-excitation relay and the undervoltage relay together would trip the unit;

3. Operation of the loss-of-excitation relay alone for one minute would trip the unit through an auxiliary timer.

The addition of the timing relay prevents indefinite operation with loss of excitation. The generator manufacturer advised that operation without field for more than one minute might cause damage.

Settings Require Analysis

The voltage relay provided fast isolation of the unit if the loss of excitation was accompanied by reduced system voltage. However, the setting of the relay could not be derived without knowing the effect of the excitation loss on system voltage and on system stability. If the setting was too high, it would permit tripping on slight swings or other situations where instantaneous tripping was undesirable. If it was too low, system instability was a real possibility.

The problem required study on the ac system calculator or other computing aids, but there were no tools for its solution in literature.

• During a severe electrical storm in September, 1955, there were a number of automatic changeovers on the Oak Creek excitation system and an outage on Unit 1, initiated by the loss-of-excitation and undervoltage relay combination. From the oscillograph recordings, it was concluded that the normal source of excitation was isolated. This was substantiated by the reversal of the collector ring voltage due to current flow in the discharge resistor. A second reversal, when the unit tripped, resulted from the sudden reduction in armature current.

The continued rise in collector ring voltage compared fairly accurately with the calculated values expected for the recorded decay in armature current. The absence of an increase in field current, even though the regulator response was positive, further indicated that the field breaker was open.

After a thorough analysis of the oscillogram, it was concluded that a changeover was caused by the voltage regulator operating to buck the main field.

Speed of the regulator is such that the changeover relay received only a momentary impulse, which caused the shaft exciter breaker to trip. The reduction in field voltage, however, was not long enough for the complete closing of the emergency excitation breaker.

Tests at Oak Creek confirmed the belief that momentary impulses on the dc field changeover relay could trip the shaft exciter breaker without closing the emergency exciter breaker. This again showed the limitations of using a dc voltage relay for field changeover.

Because of these problems it appeared impractical to use automatic voltage regulation and the existing method of starting automatic field changeover on the same machine. Therefore, the automatic field changeover scheme has been made inoperative until a new initiating scheme can be developed.

Development of a new changeover scheme is closely allied with selection of a proper setting for the voltage relay in the loss of excitation scheme. The earlier studies started to determine the exact behavior of machines and the system during a loss of excitation therefore took on added significance.

A method for analysis of this problem on the ac network calculator was developed by L. J. Bischel of the System Engineering Group and the author. Tested on the calculator at the University of Wisconsin, it showed that the loss-of-excitation scheme, using the voltage relay to monitor tripping, is basically correct for our system.

• A loss of excitation operation of Oak Creek on May 17, 1958, provided a practical test of its validity. Investigation showed that the drive supply to the automatic regulator on Unit 4 failed, reducing excitation to the high speed machine. The loss-of-excitation relay operated and sounded its alarm. Since the system was able to supply vars for this "induction generator," the undervoltage relay did not close and immediate tripping did not occur. Unfortunately, the operator was unable to correct the loss of excitation and the unit tripped after one minute.

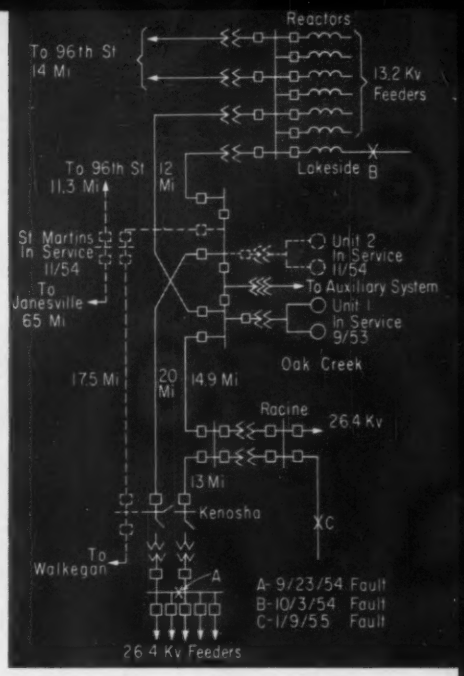


FIG 3. SYSTEM CONNECTIONS and fault locations are indicated. Dotted lines show later modifications

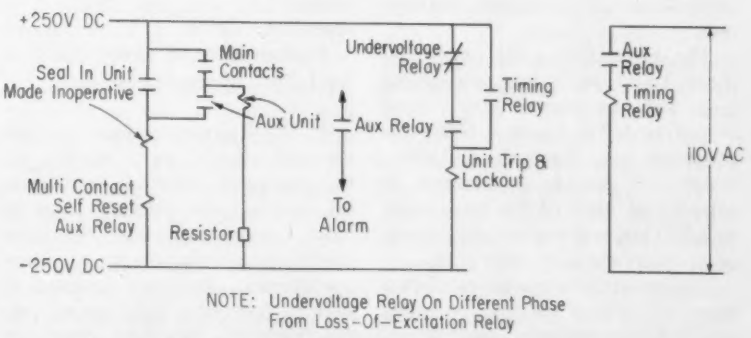
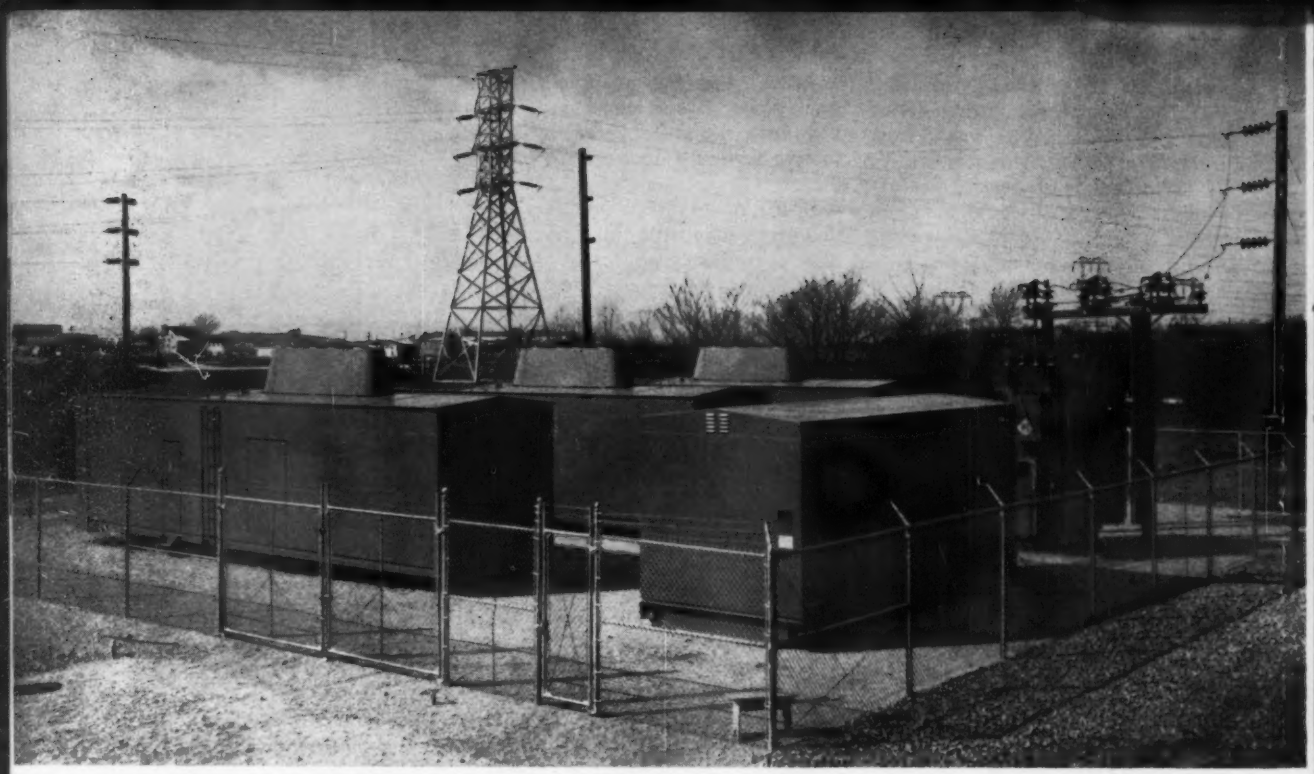


FIG 5. RELAY CONNECTIONS WERE MODIFIED to prevent operation on minor voltage swings. Timing relay prevents indefinite operation without excitation



Peak-Shaving Diesel Generating

R. M. PENNYPACKER, Superintendent of Substations, Philadelphia Electric Co, Philadelphia, Pa.

Initial operating data on three peak-shaving diesel generating units installed at Philadelphia Electric Co's Plymouth Meeting Substation indicate that a minimum of operating trouble has been observed and the units are operating satisfactorily. Economic studies are being continued to determine the desirability of installation of peak-shaving units at other locations throughout the system.

The generating units consist of three 1,400 kw power generating units and one control unit. Total output is 4,200 kw at 4,160 v, 3-phase, 60 cps. Turbocharged units, which will provide an increase in capacity of each of the three units to 2,000 kw, will replace the present units when available this year.

The generators are operated two hours a day over the peak on Monday to Friday inclusive, with an occasional additional run for 2-hr periods during exceptionally heavy load times. The table shows the operating and maintenance record for the first twelve months of operation—from February 20, 1959, to February 29, 1960.

Seven Failures Recorded

There have been 274 starts of all three units for load purposes, or a total of 822 individual machine starts. Of these 822 starts, on seven occasions one of the three machines has failed to either start or to synchronize and load during the normal fast start operation. This represents 0.85% of the total starts.

Failures to start were caused by the following conditions:

1. No. 3 generator failed to synchronize due to poor contact on the generator potential transformers, causing the primary fuses to blow. Some time later the same condition occurred on the auxiliary transformers, but was detected in time to prevent a delay in starting the machines. In both cases the manufacturer adjusted the main contacts, installed new latches and reinforced the hinges on the transformer compartment doors. The manufacturer is expected to improve the design.

2. No. 1 unit failed to start due to a defective relay dashpot.

3. No. 1 unit started but did not come up to speed for 3.5 min, and then shut down. This was caused by an open-circuited governor solenoid coil.

4. No. 1 unit tripped 4.5 min after starting, due to loose mounting screws of a micro-switch which had not been sufficiently tightened when the new governor coil was installed.

5. No. 2 unit failed to start due to low engine water temperature. The unit was then started manually.

6. No. 2 unit shut down due to insufficient fuel supply caused by a cracked oil line to the fuel pump.

7. No. 1 unit failed to start due

Only 0.85% of total starts failed to start or come up to speed during slightly more than one year's operation

Performance Record of Diesel Peak-Shaving Units
(February 20, 1959, to February 29, 1960)

Total Hours Run	559
Net Kwhr Generated	2,369,700
Auxiliary Transformer (Station Losses)	246,960 Kwhr
Gallons of Fuel Oil Used	187,713
Btu per Net Kwhr (cumulative)	10,840
Gallons of Fuel per Hour of Operation	335
Gallons of Fuel Oil per Net Kwhr	0.079
Net Kwhr per Gallon of Fuel Oil	12.62
Gallons of Lubricating Oil Used	550

Heat rate is based on 136,844 Btu per gallon of No. 2 fuel oil.

PEAK-SHAVING DIESEL UNITS went on line February 20, 1959, at Philadelphia Electric Co's Plymouth Meeting Substation. Of 822 individual machine starts, the units failed to come up to speed or start only seven times

Units Found Reliable

to a defective engine speed control relay.

It will be observed from the above list of troubles, all of which were detected by the protective and alarm devices, that five of the cases were due to electrical and two to mechanical trouble.

Minor Troubles Developed

Other minor cases of mechanical and electrical troubles have developed during this period, all of which have been given prompt attention by a manufacturer's service engineer. As this is one of the first applications of multiple units for peaking service, it is to be expected that mechanical and electrical adjustments, as well as some design improvements in certain critical components, would need to be made.

Major maintenance, such as inspection of engine and changing of lubricating and fuel oil filters, is not expected to be required in less than 1,000 hr of operation, which is equivalent to about two years of operation based on the present schedule.

Engines are started, synchronized, and loaded to full capacity in rapid succession by the operation of a single control switch located in the substation control room. Two methods of starting are provided from the one switch—"Normal," which requires an average of 90 sec to start, synchronize, and load, and "Fast," which takes about 60 sec. Only fast starting is used and stopwatch checks on all starts have indicated starting times ranging from a minimum of 46 sec to a maximum of 82 sec.

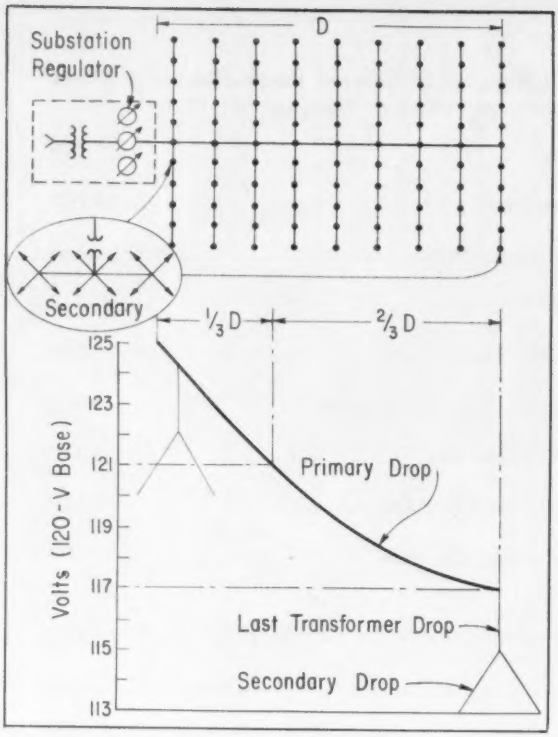
Unit Compactly Constructed

The power unit is compactly contained in a sound-insulated steel housing. An electric starting motor supplied from a storage battery located in the control unit is mounted on the engine. A magnetic amplifier-regulated static exciter supplies the generator field, receiving its power from transformers located in the control unit. Also located in the unit are the various devices concerned with engine operation, such as oil cooler, filters, speed control governor, pumps, ventilating fan, and exhaust muffler. Each power unit is 38 ft long, 10 ft 4 in. wide, 11 ft 4 in. high and weighs 103,000 lb.

Control Unit Separate

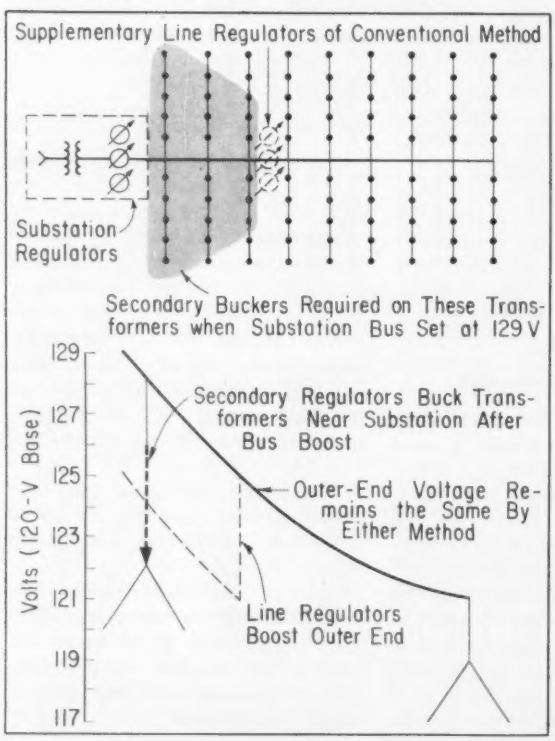
The control unit, also compactly constructed, contains the 4,160-v metalclad bus, three generator air circuit breakers, auxiliary power transformers, potential and current transformers, control switchboard, 120-v starting battery with automatic charger, voltage regulators, synchronizer, and all electrical control and indicating instruments and watthour meters. The control unit is 24 ft long, 10 ft 6 in. wide, 11 ft 4 in. high and weighs 56,000 lb.

The three generators are connected through cable to the 4,160-v bus in the control unit, which is in turn connected to the system through a 7,500-kva, 4/33-kv transformer provided by the power company. The three power units, the control unit, and the step-up transformer are enclosed within a 90-ft square fenced area.



TYPICAL FEEDER serving distributed load (upper diagram) has half its drop in first third of distance. This case calls for supplementary regulation of about 4 v

SUPPLEMENTARY REGULATION boosts outer-end voltage with line regulators or with substation regulators after secondary regulators buck close-in transformers



New Approach

Secondary regulators at off-limit transformers, plus voltage boost at substation, extend economic limits of circuit loading

R. F. LAWRENCE, Manager, Distribution Engineering,
D. N. REPS, Distribution Engineer, Westinghouse Electric Corp, East Pittsburgh, Pa.

Supplementary regulation at selected distribution transformers offers more economical control of distribution voltage than the conventional use of line regulators along the primary feeder. The new method, using a recently-developed automatic secondary-voltage regulator, overcomes voltage limitations in designing distribution systems for the optimum economy. It also provides an economical corrective for voltage problems encountered on existing distribution.

All distribution design is affected by the need to deliver satisfactory voltage to connected customers and the methods used to regulate and re-regulate circuit voltage. Accordingly many distribution systems and thousands of circuits have been surveyed to ascertain the best solution to the voltage regulating function, ignoring the "handcuffs" of existing apparatus and concepts. The objective was to determine which system supplies all connected customers with satisfactory voltage at the lowest total cost.

The first step was a comprehensive analysis of distribution system design and cost, using a digital computer to compare thousands of alternatives. The survey included subtransmission, substations, primary feeders, distribution transformers, and secondaries. Many of these systems required supplementary voltage regulation to maintain service voltage at acceptable, prescribed levels. Supplementary voltage regulation was required also to gain the optimum economy from large distribution substations with longer and more-heavily-loaded primary feeders.

Analysis Compares Alternative Methods

The analysis included several alternative means of supplementary voltage regulation for the distribution system; among them the conventional line-voltage regulator and a voltage-regulating device associated with individual distribution transformers.

At this point a universal characteristic of system behavior was recognized and put to work to cut regulation and system costs. That universal characteristic is a voltage profile having the steepest slope near the source, where current is greatest. The slope becomes more gradual farther out in the circuit as current is reduced by branching off laterals or tapping off loads. This characteristic penalizes the conventional line-voltage regulator which, to re-regulate feeder voltage, must be so located that ⅔ of the feeder load lies beyond it. The regulator's rating and cost are governed by the requirement that it handle ⅔ of feeder load.

On the other hand, the typical voltage profile can be exploited to economic advantage by setting the substation bus regulator to hold 129 v at heavy load

Cuts Distribution Regulation Costs

and applying suitable automatic bucking devices in series with each distribution transformer between the substation and points on the feeder where voltage has dropped to 125. Less than ⅓ of the distribution transformers on a feeder would need such a regulating device.

Obviously the regulating device could be applied also to boost the voltage of each distribution transformer beyond the point where the feeder's profile calls for re-regulating. But note that ⅔ of the total distribution transformers on the feeder would require such a device. Boosting the substation bus voltage from 125 to 129 over the peak and using voltage regulation at distribution transformers to buck, rather than boost, requires half as many regulators to accomplish the same task.

Thousands of residential circuits, serving varying load densities, types of load, and customer saturations, were studied. Many of them required supplementary voltage regulation. The cost of providing this with conventional line regulators was estimated. Then the new concept—raising the substation bus voltage so customers at the end of the feeder would receive satisfactory voltage and applying a bucking device to each distribution transformer where customer voltage would otherwise be too high—was applied.

Dividing the calculated total investment for conventional line-voltage regulators by the number of distribution transformers which would, by the new concept, require bucking regulators gave the breakeven cost per device. Plotting this breakeven investment per regulating device computed from each of the many thousands of systems studied established a band ranging from $150 to $1600 or higher, depending upon the number of customers per sq mile in the primary-feeder load area.

Hence, if a suitable regulating device were available at about $200 for application at distribution transformers, it would be more economical than conventional line-voltage regulators for virtually all supplementary regulation applications.

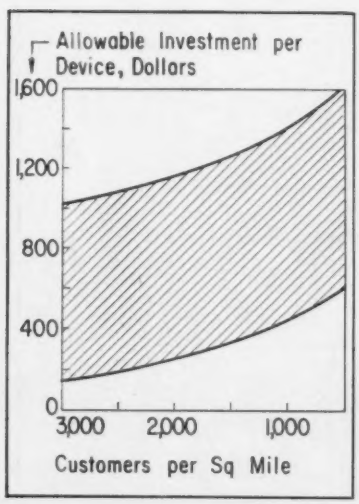
Applicable to Existing Distribution

While the economic benefits of regulating voltage at the distribution transformer seems clear for new, optimized systems, regulation problems in existing systems are also important. Two typical examples of such circuits, on which extensions and load growth require correction, are shown.

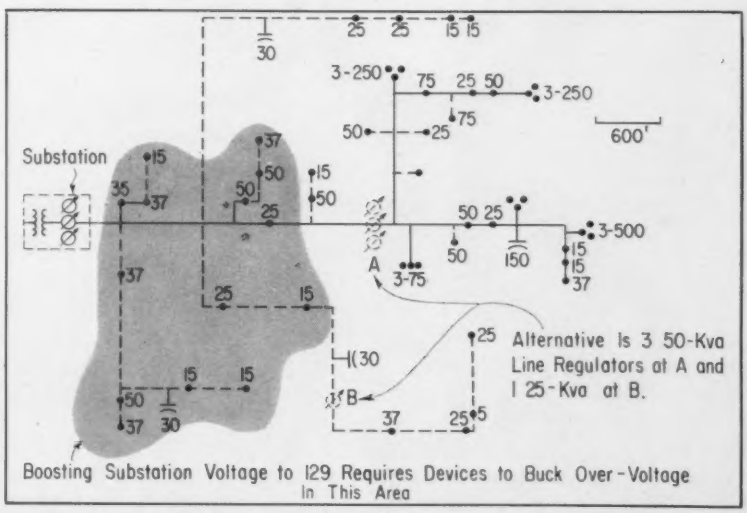
The 4.16-kv circuit shown below serves a 0.46-sq-mile urban-suburban residential area. Loading on the feeder is 2,600 kva. Single-phase portions are shown by dashed lines and the black dots represent single-phase distribution transformers. Occasionally three transformers are connected to form a 3-phase bank. Several shunt capacitors are also connected to the feeder circuit, being applied to raise the light-load power factor to unity.

The maximum voltage permitted on the feeder is 125, the minimum 121. Hence a four-volt spread can be tolerated. But when the substation bus is regulated at 125 v (on a 120-v base), voltage drops below 121 at all points beyond A on the main trunk and B on one of the laterals. The lowest voltage is at point C, where 117 is measured. Hence supplementary voltage regulation is required.

This supplementary regulation can be provided by line regulators at A and B. A three-phase bank is required at A and a single-phase regulator at B. These regulators boost the voltage, at their point of application, from 121 to 125 during the peak period. The three 50-kva units at A and the 25-kva unit at B



SECONDARY REGULATORS justified if installed costs are below these values



TYPICAL 4-KV CIRCUIT at 2,600 kva is re-regulated by boosting substation to 129-v and bucking voltage of 14 close-in transformers in shaded area

represent an investment of $12,000, installed.

Supplementary voltage control for the low-voltage areas of the 4.16-kv circuit can also be achieved by resetting line-drop compensators on the substation regulators for 129 v at peak load. Then the maximum permisible primary voltage of 125 would be exceeded in the shaded area near the distribution substation, but voltage drop in the feeder conductor would reduce the voltage to 125 or lower within a reasonably short distance.

Every distribution transformer within the shaded area would need a voltage device to buck its output voltage to 125 or somewhat lower. In the remainder of the feeder's service area, voltage at peak load would range between 125 and 121 volts, so that no other re-regulation would be needed.

Cost Reduced by Limited Use

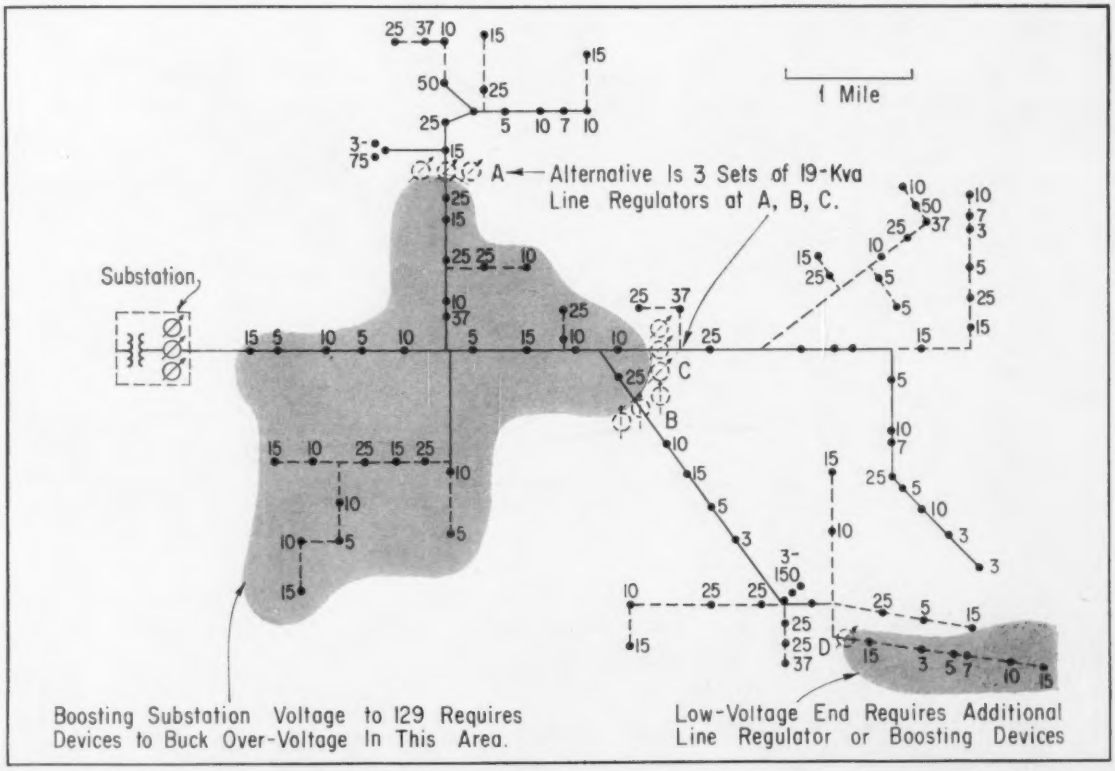
To arrive at the allowable cost for these regulating devices, note that they are required on only 14 distribution transformers within the shaded area (page 57). These 14 units take the place of conventional line-voltage regulators estimated to cost $12,000, installed. Hence if such a device were to cost less than $860, installed, it would supplement voltage regulation on the circuit at lower cost than conventional line regulators.

A typical 13.2-kv feeder serving a rural area, is shown below. Its voltage profile would require three 3-phase and one 1-phase installations of line-voltage regulators for a total of $27,000. The total voltage drop is so great that, even with a voltage boost at B, another is required at D, as well.

In terms of regulation at the distribution transformer, the need for 2 steps of conventional re-regulation in cascade means that, in addition to bucking devices associated with transformers at the head-end of the feeder, some additional devices are needed to boost the output voltage of transformers at the tail end of the feeder. This is shown by the shaded area beyond point D, below. Thus a device capable of boosting or bucking, automatically, is most desirable.

The circuit shown below requires a total of 40 regulating devices at distribution transformers, 34 called on to buck and 6, to boost. The allowable investment (installed) per device required to re-regulate the 13.2-kv circuit would be 1/40th of $27,000 or $675 per device.

These typical cases, and many others like them, show that a simple, reliable, and inexpensive regulating device at individual distribution transformers where voltage is outside acceptable limits can save electric utilities thousands of dollars compared with the cost of conventional methods. One such device, designed to sell for $150, is described on p 65. This device would save the utility $5,861 on the 4-kv circuit, and $12,120 on the 13.2-kv circuit below where it replaces cascaded regulators.


1 Mile
A ← Alternative Is 3 Sets of 19-Kva Line Regulators at A, B, C.
Substation
B
C
D
Boosting Substation Voltage to 129 Requires Devices to Buck Over-Voltage In This Area.
Low-Voltage End Requires Additional Line Regulator or Boosting Devices

TYPICAL 13.2-KV RURAL CIRCUIT at 2,100 kva is re-regulated by boosting substation to 129 v and bucking 34 close-in transformers. Long 1-phase tail requires boosting 6 transformers in lieu of conventional line regulator in cascade

Change hats
with your maintenance man, he will demonstrate...

WHY GENERAL ELECTRIC
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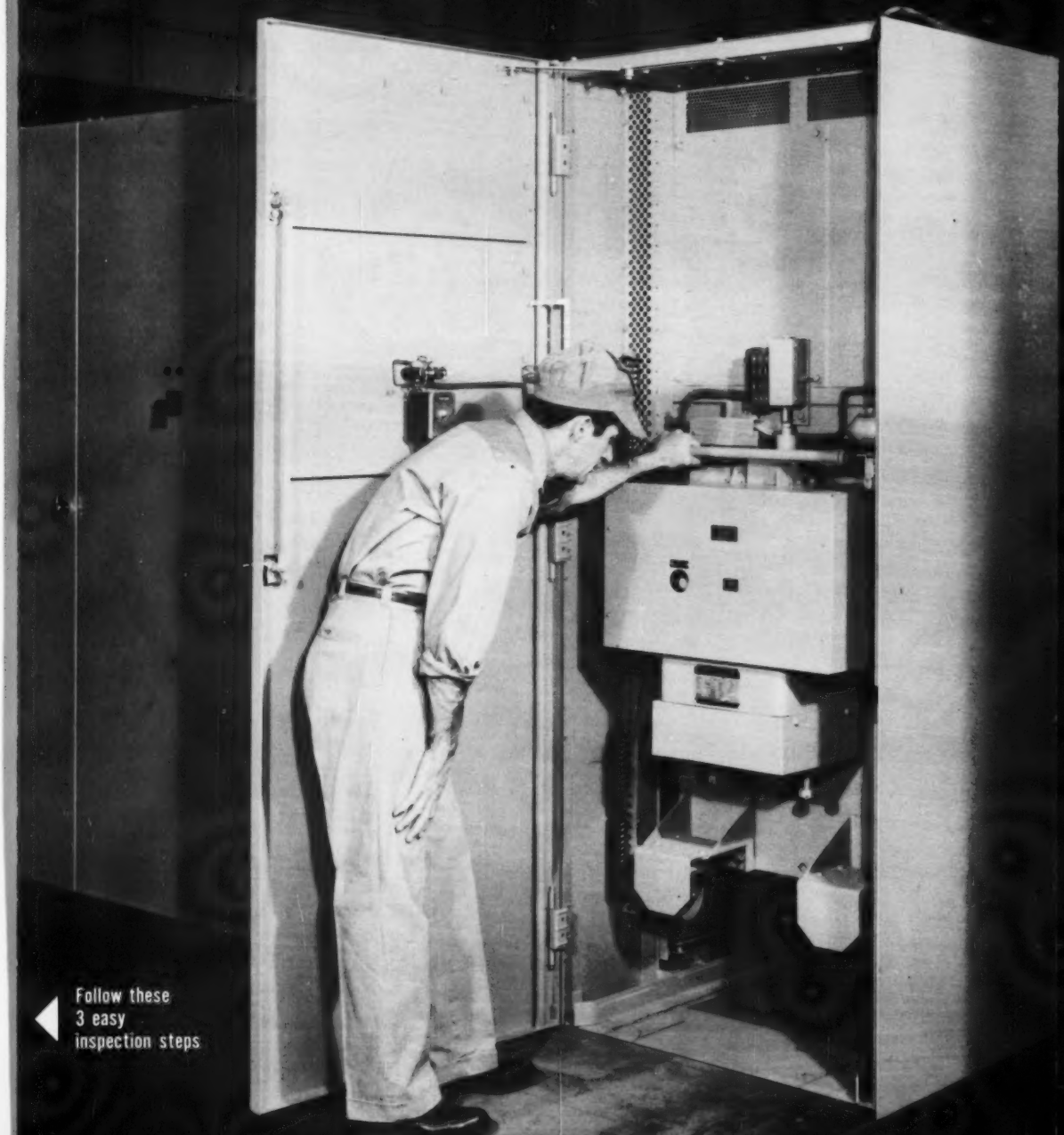
METAL-CLAD SWITCHGEAR



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3 easy
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General Electric manufactures ONLY Vertical Lift Metal-clad because...

General Electric's exclusive *Vertical Lift* design gives you superior switchgear performance... these operational benefits

1 Visible circuit breaker safety protects your personnel — helps prevent wasteful outages

General Electric Vertical Lift is the only switchgear design which allows your operator to actually *see* when the primary disconnects are parted . . . a safety bonus that also reduces the possibility of costly equipment outages.

Safety you can see is a prime reason why General Electric manufactures Vertical-Lift design Metal-clad switchgear.

2 One minute contact inspection saves you costly maintenance time

General Electric Vertical Lift design lets your maintenance man expose the contacts in just one minute for cleaning, inspection, and adjustment. This efficient maintenance reduces your operating expense. Quick, easy contact servicing that contributes to the over-all economy of General Electric Metal-clad installations is another reason why General Electric manufactures Vertical Lift design switchgear.

3 Up-front location of operating mechanism cuts your installation, maintenance costs

G-E Vertical Lift design gives you another cost saving through placing the breaker operating mechanism and controls up front. Even the stored energy operating mechanism is mounted up front for easy access, reducing maintenance time and expense.

4 20-minute routine maintenance means less service man-hours — more productivity

Under normal conditions, your maintenance man can remove G-E Magne-blast breakers from their housing, give routine maintenance, and return them to service in 20 minutes. General Electric's exclusive Vertical Lift design contributes increased switchgear efficiency —in both operating and maintenance phases—to your Metal-clad switchgear installation.

5 Magne-blast circuit breaker action gives you effective system protection

General Electric's Magne-blast breaker design gives you positive, three-phase interruption and fast, clean arc extinction — a combination that assures high reliability, top switchgear performance. Extensive factory quality control, and testing at full-rated interrupting capacity maintain the uniformly high operational standards of G-E Vertical Lift Metal-clad switchgear.

Both General Electric assemblies and Magne-blast circuit breakers are shipped completely assembled. This service feature results in greater safety for personnel and reduced installation time and expense.

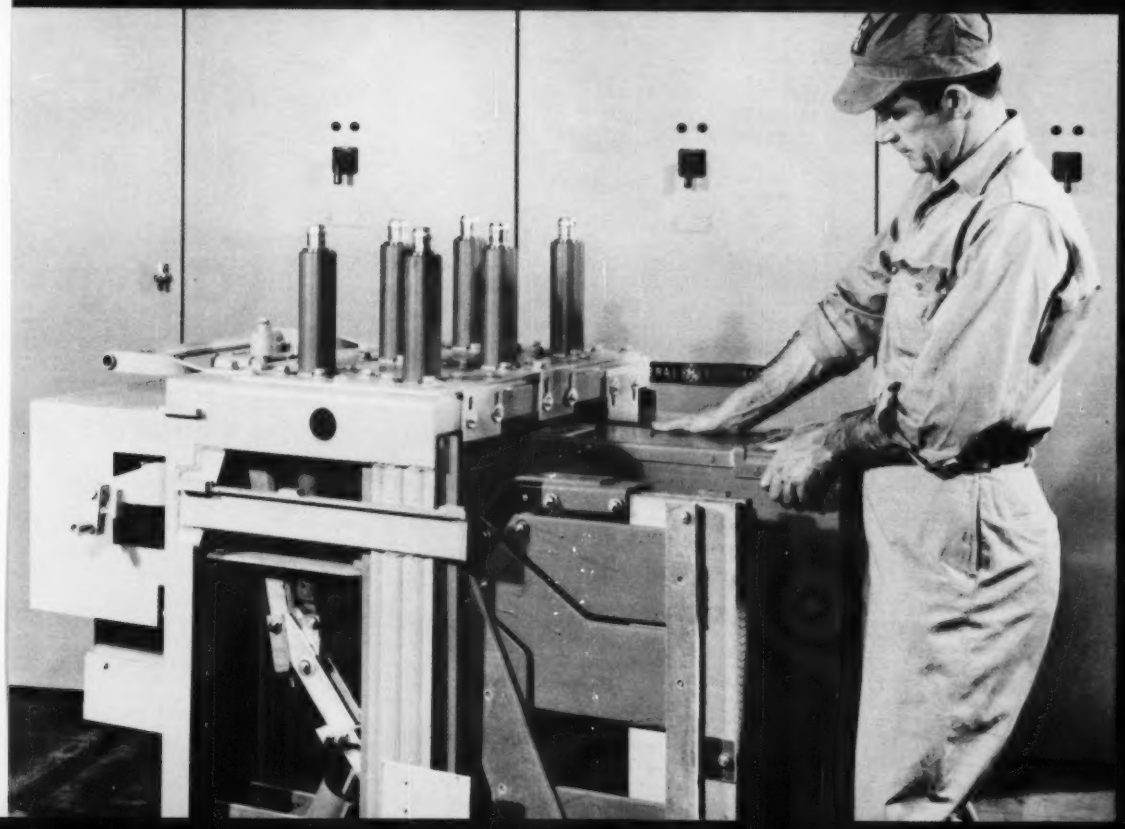
G-E Metal-clad is available in voltages from 4.16 to 13.8 kv, and in interrupting capacities from 75 to 1000 mva. This full range of voltages and capacities enables you to select switchgear "tailored" to your present or projected system needs . . . yet you pay no premium for special engineering or construction, thanks to many conventional ratings.

FOLD OUT FOR STEP 3 ▶

GENERAL ELECTRIC

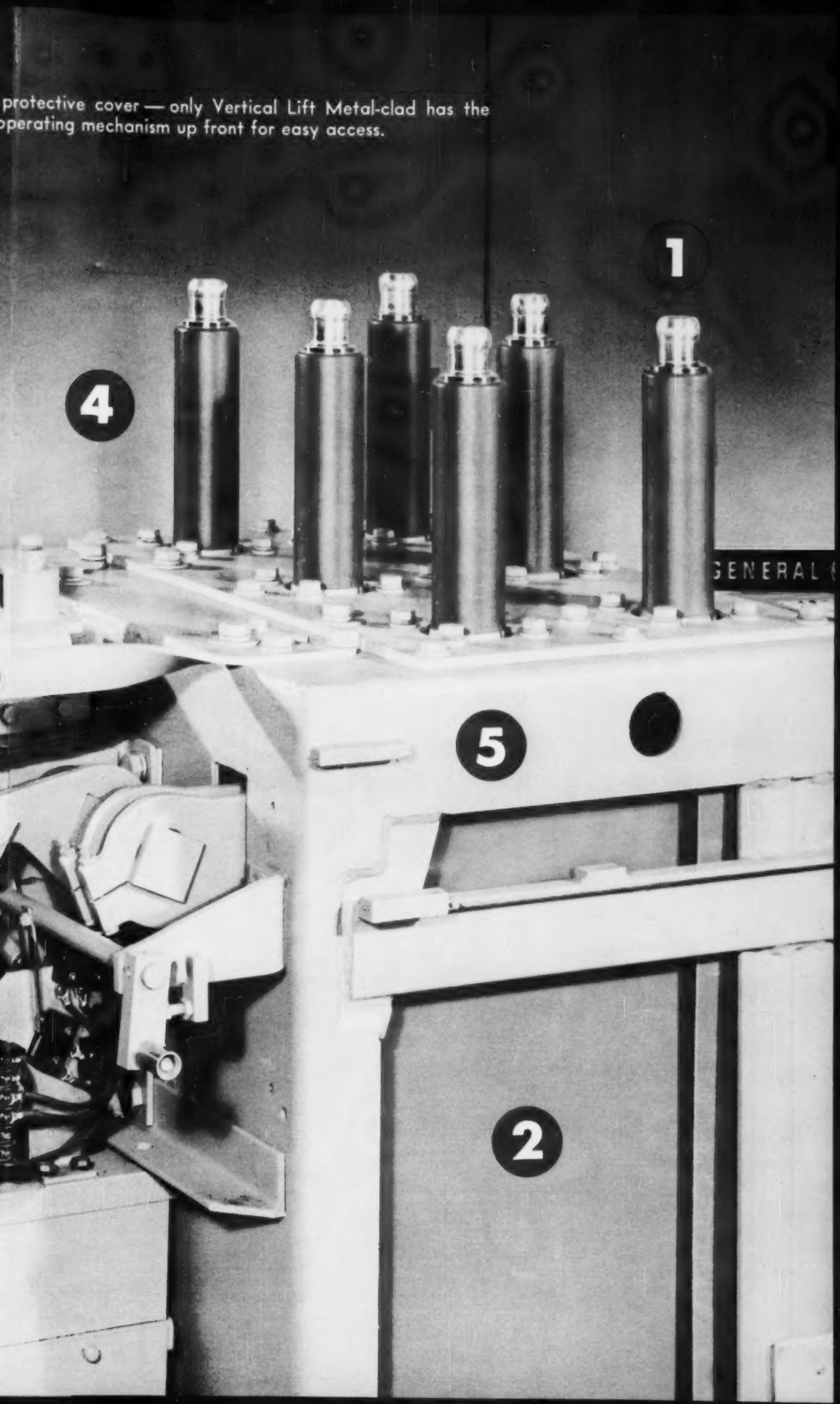
STEP 1: Disconnect breaker automatically—only Vertical Lift design permits operator to actually see when disconnects are parted.

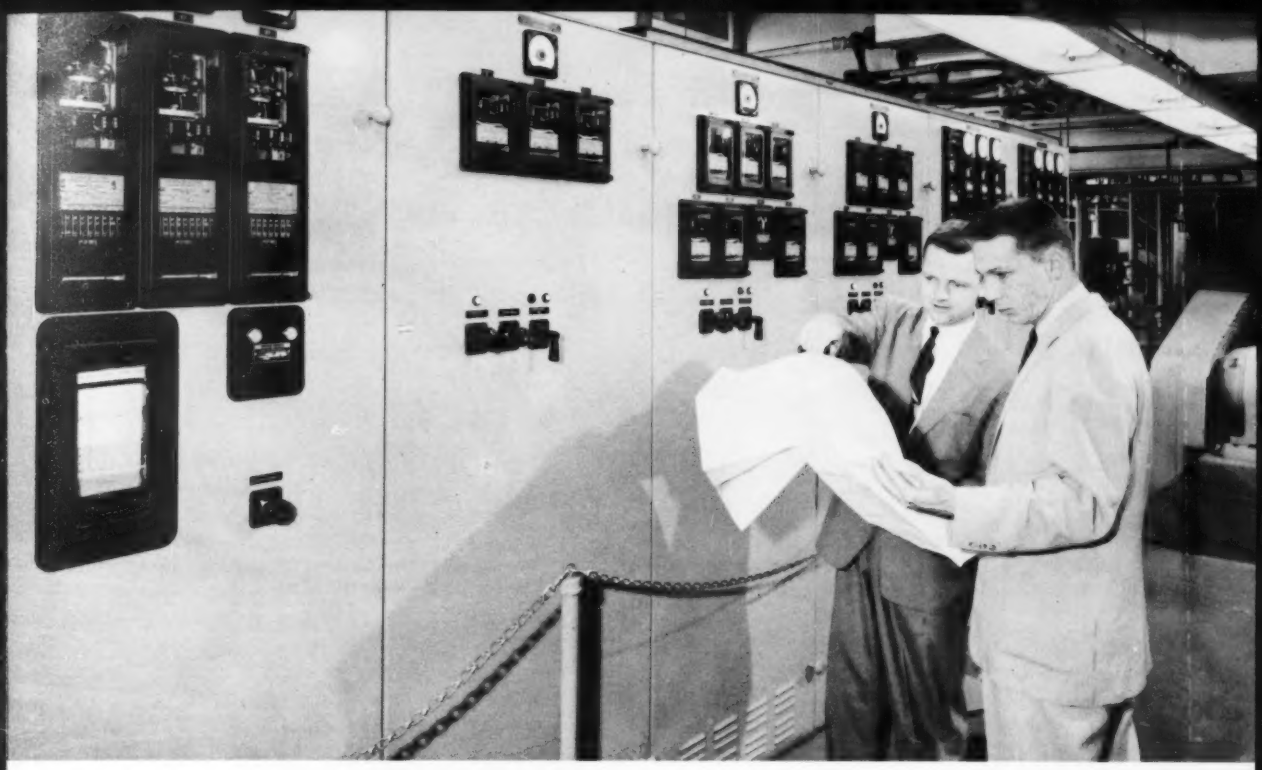
STEP 2: Remove breaker, box barrier — Vertical Lift design allows operator to inspect contacts without removing arc chutes.



STEP 3:
Remove pro
breaker ope
3

protective cover — only Vertical Lift Metal-clad has the
operating mechanism up front for easy access.





In addition to exclusive design features...

G-E application and service engineers pre-engineer your Metal-clad switchgear installation... give continuing service

The first step in the extensive service you receive with General Electric Metal-clad switchgear is the expert problem-solving and planning assistance from your G-E sales engineer.

Next, G-E application engineers study your system, offer suggestions for efficient, economical installation, and monitor project progress.

G-E guide-form specification sheets simplify the ordering of Metal-clad switchgear units — your engineering expenses can be reduced through the use of this General Electric system planning assistance.

When necessary, your Metal-clad equipment is inspected and test-checked at the time of installation to assure a satisfactory hook-up to your power distribution system.

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Progress Is Our Most Important Product

GENERAL ELECTRIC

Secondary Regulators Implement New Concept

J. ASTLEFORD, Design Engineer,
M. G. LEONARD, Section Manager, Distribution Transformer Engineering,
Westinghouse Electric Corp.

Economical regulation of distribution circuit voltage often calls for supplemental re-regulation to correct high or low voltage on a few transformers. This can be accomplished (1) by a regulating mechanism in the transformers themselves, or (2) by connecting small supplemental regulators—a new device—between the transformers' secondary terminals and their connected load. The latter method can be applied to almost any distribution transformer regardless of type or primary voltage. With only two ratings of regulators, it can buck or boost the output voltage 5% for 602 standard ratings of transformers up to 50 kva. These regulators were developed to implement a new concept of distribution circuit regulation described elsewhere in this issue. But they are applicable also to correct low voltage at the ends of long feeders and at service connections subject to erratic voltage deviations.

The new automatic regulator is self-contained, mounted in a small, oil-filled tank, and can be connected at any convenient place between the low-voltage terminals of the transformer and its load. It comprises two basic parts: an induction regulator and a voltage-sensing mechanism. A 1¼-kva unit is now available for transformers up to 25 kva, and a 2½-kva size will soon be developed for 37.5 and 50 kva transformers.

Uses Induction Regulator

The induction regulator was selected as the voltage-correcting element in this new device because of its reliability and maintenance-free operation. It smoothly corrects the output voltage by inducing a voltage in its series coils which either adds to or subtracts from the input voltage. Two such coils, one in each leg of the 240-v circuit, provide balanced regulation for the 120/240-v secondary.

Voltage induced in these coils is controlled by varying the angular position of the rotor on which the primary is wound. The rotor is positioned through a self-locking worm gear which turns the rotor at ¼ rpm, equivalent to 1¼% voltage correction every 15 sec. A brake is unnecessary as the rotor coasts less than 0.2 v after the motor is turned off.

The regulator will boost input voltage 5% at 150% of nameplate rating. When loaded at the maximum continuous capability of modern CSP transformers, about 180% of nameplate, the regulator can still boost input voltage about 4½% with negligible distortion of waveform.

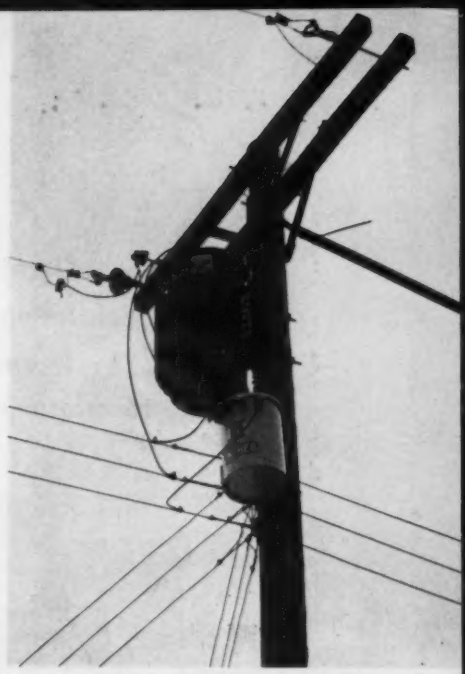
Static Control Encapsulated

A special control system without moving parts or contacts was developed to match the reliability of the induction regulator. It uses solid-state components throughout and is set for a mid-point of 122 v, allowing 2 v for secondary drop. It is temperature compensated to meet the accuracy requirements of a NEMA Class II voltage-regulating relay, and encapsulated to make it rugged, reliable, and tamperproof.

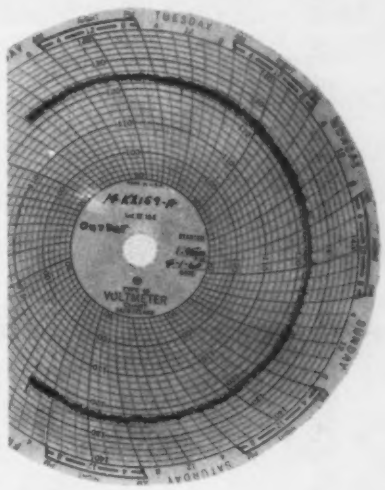
Installation of the regulator is simplified by a lifting eyebolt and mounting bracket with standard 12-in. bolt spacing. Standard LV transformer bushings are color-coded for quick, easy connection; brown for input and green for output. All connections are made externally on the low-voltage side of the transformer, requiring that load be dropped only for the few minutes necessary to make the final secondary connections.

The new regulator has been subjected to all commercial tests usually specified for this type of electrical apparatus. Accelerated life tests showed no measurable wear of rotor bearings after a period equivalent to 40 years of service, and the gear motor and limit switches were still operating after several hundred thousand operations. The static controls have withstood accelerated life tests at temperatures from —20C to 50C without adverse effects on the control's operation or calibration.

Another important test was installation of two 1¼-kva regulators on a utility system. Recording meters connected to one of these, on a 25-kva transformer at the end of a 4,160-v feeder, showed an average of 50 corrections a day to hold the output voltage within the 2.5-v bandwidth.

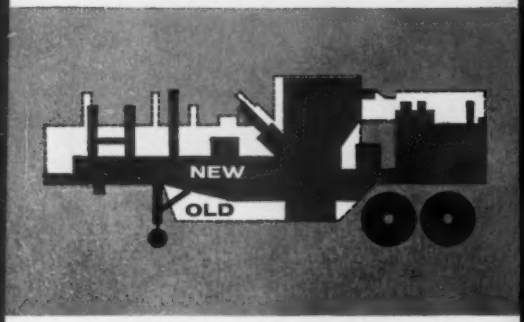


TRIAL INSTALLATION with 25-kva transformer at end of 4-kv feeder holds the voltage chart within 2.5-v band

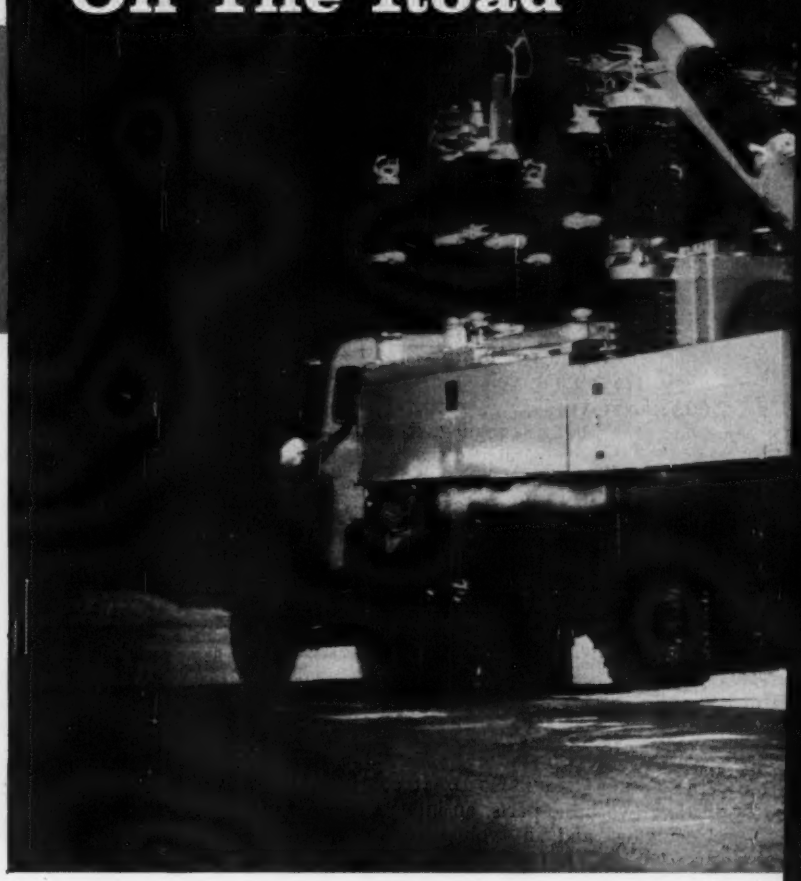


General Electric
Mobile Substations
and
Mobile Transformers

All New Mobile Design Gives You More Kva per pound On The Road



Higher capacity, lower weight of General Electric mobile units open new areas for savings and service to utilities.



- **Reduces Investment in Unused Capacity**
- **Cuts Operating Cost**
- **Improves Customer Service**

Dramatic improvements in General Electric mobile substation and mobile transformer designs now make possible far more kva per pound on the road than ever before. Complete mobile substations rated up to 20,000 kva, 115 kv and mobile transformers up to 40,000 kva, 138 kv are now available from General Electric. Typical of these units is the 17,000 kva, 115 kv substation shown above.

Progress in Design

A 705 computer cuts engineering time, while determining the optimum transformer design in all areas of consideration such as cooling, insulation, size and weight —whatever the kva and voltage rating requirements.

New straight-beam trailer provides a lighter, stronger unit.

Simplified low-voltage switchgear with a 5-cycle, outdoor-type circuit breaker reduces weight, speeds interrupting time.

Use of Formex* turn insulation for all windings rated 350 kv BIL and below permits safe loading beyond the normal 55 C rating, thus effectively increasing the available kva.

Progress such as this pays off for you in better mobile substation and transformer designs, faster delivery . . . and the most kva per pound on the road!

Economical System Operation

Enjoy savings in many ways from these flexible utility tools. For instance, a G-E *mobile substation* can bypass a complete permanent substation permitting planned maintenance during regular hours with no loss in service and with increased safety to personnel. Careful scheduling means higher-quality maintenance.

System changeovers can be made quicker, more economically, and without service interruption. New loads can be picked up immediately.

Mobile transformers can help reduce your investment in spare capacity! They can provide the necessary back-up protection for emergencies at far less cost than spare stationary transformers or underloaded transformers. All stationary units on the system can be put in service and loaded to capacity.

These are only a few of the ways your utility can profit with General Electric mobile substations and mobile transformers. Get the full story from your G-E Apparatus Sales Office; or write Section 422-44, General Electric Co., Schenectady 5, N. Y.

* Registered Trade-mark of General Electric Co.

GENERAL ELECTRIC

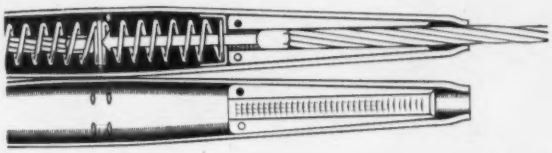
Develop Mechanical Splice For ACSR

A mechanical compression splice for ACSR conductors, consisting of a tube with wedge-shaped jaws that grip conductor ends, has been developed by Reliable Electric Co. Jaws are held in position by springs in the center of the tube, and the conductor is inserted in the pilot cup and pushed to the center of the splice. Jaws of the splice are then wedged against the conductor as tension is applied. This type of splice and dead end has been used with copper conductors for many years.

Development of a suitable design for ACSR conductors revolved around the problem of transferring the pressure of the jaws through the aluminum strands to the steel core. The solution was found in the development of an elliptical two-piece jaw. The round three-piece jaw, the typed used for copper splices, did not develop enough of the ACSR conductor strength to prove satisfactory.

In a series of tests of these splices, the strength developed ranged from 89.0% to 99.1% of the rated strength of the conductor. These results indicate that the splice using the two-piece jaw has satisfactorily solved the problem of transferring pressure through the aluminum strands to the steel core. Resistance of the new mechanical compression splice is lower than the resistance of an equivalent length of conductor.

Sizes No. 4 and 2 in 6/1 and 7/1 stranding and 1/0 in 6/1 stranding are available. Development work is being done on splices and dead ends for conductors in larger sizes.

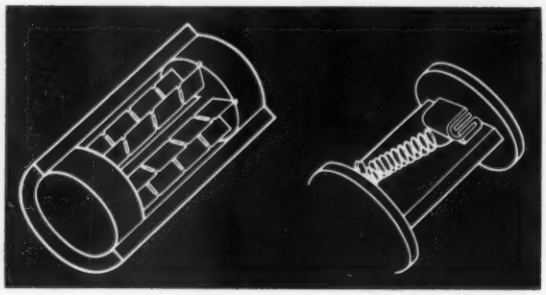


Test No.	Type or Size	Failure Strength (lb)	Location of Failure	Effective Strength (% of Conductor rated strength)
1	1/0 ACSR	3,940	At jaws	92.1
2	"	4,240	At jaws	99.1
3	"	4,020	At jaws	94.0
4	"	3,870	At jaws	90.5
5	"	4,060	At jaws	95.0
6	"	3,900	At jaws	91.2
7	"	3,810	At jaws	89.0
8	"	3,950	At jaws	92.4
9	"	3,990	At jaws	93.3
10	"	4,090	At jaws	95.6

Fuse Combines Two Protective Features

A high-quality fuse developed by Bussman Manufacturing Div, McGraw-Edison Co, will provide a 10-sec time delay to prevent its blowing on motor starting or other short-time surges and will assure protection with great speed on heavier overloads.

The time lag element of Bussman's Fusetron is combined with the silver link element of its Limitron to produce a fuse, called the Low-Peak, that coordinates with other elements of the system such as switchgear, motors, and conductors. The fuse curve follows the European style.



TWO ELEMENTS are combined for greater protection. At left is instantaneous element; at right, time-lag portion

The new fuses are available in a variety of ratings ranging from 15 to 600 amp and in 250 and 600-v ratings. The thermal element handles loads up to 500% of the fuse rating and will safely interrupt faults on circuits that deliver up to 200,000 amp.

The tremendous increase in the capacity of distribution lines and transformers has resulted in a corresponding increase in available short-circuit currents. These higher short-circuit currents require extremely high interrupting capacity.

However, there is still the need for delaying fuse operation in cases of motor starting and short-time current surges to avoid unnecessary interruption to production. The time-lag feature of the Low-Peak fuse performs that function.

The two elements have been packaged in a fuse cartridge of normal dimensions. It fits standard fuse holders.

PCEA Hears Dillin

(*Continued from page 50*)

punch cards may be selected and sorted automatically. A monthly report lists interruptions and their particulars segregated by district and division. Annual reports include

1. Summary of outages classified by cause for use in checking quality of construction methods and materials

2. Summary of relay reliability for analyzing relaying practices and efficiency

3. Repeating circuit-outage report which points out areas where work is most required.

Special reports or tabulations of information can be prepared quickly and easily from the punched cards at any time, said Mosquini. Distribution people, protection engineers, load dispatchers, and substation personnel will benefit by availability of the information.

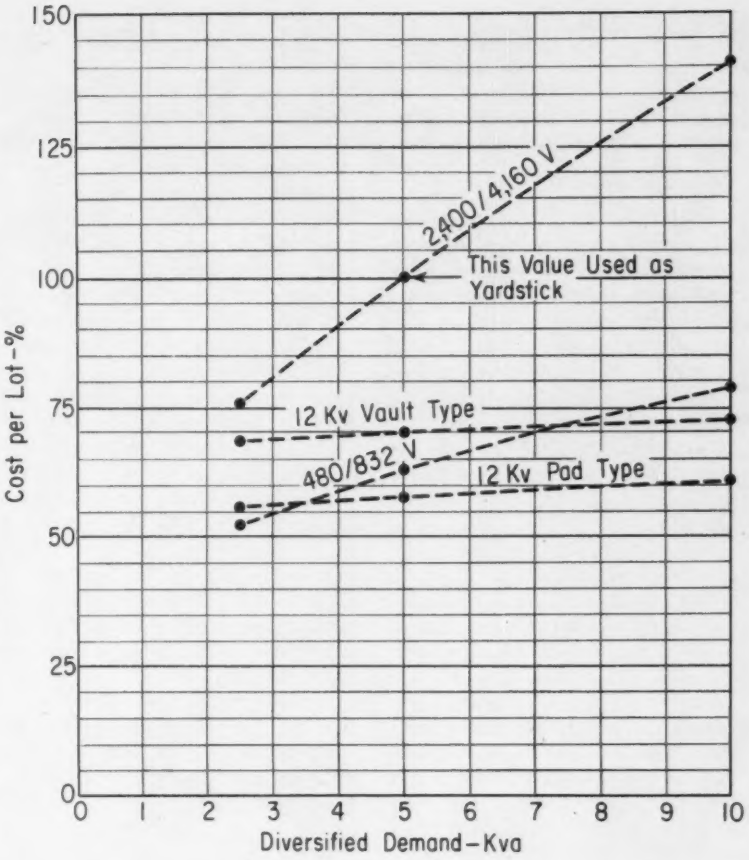
240/460 V Favored

The 240/460-v system is intrinsically more economical for distribution than the 265/460-v system for general use by utilities, because the voltage to neutral and the 3-phase voltage are suitable without further transformation, said A. S. Anderson, Ebasco Services. He urged utilities to subsidize initial installations because of the adverse temporary economic situation regarding 240-v-to-neutral systems. Utilities should take action in supporting code changes and adoption of standards so that equipment cost differences will be eliminated.

Besides established uses of aerial lifts, PG&E has used them for experimental work in stringing dead conductors in new subdivisions and elsewhere, said P. C. Oldershaw. Two men can work on the primary and secondary conductors, exclusive of hanging transformers. The work was completed in about the time normal for five-man crews, he said.

Although the lift performed as expected, playout reels with adequate and easily controlled brakes are a "must." Furthermore, said Oldershaw, conductor packaging will have to be standardized.

Transmission tower spotting by computer saves more than $1,000 per mile, said V. Converti, Arizona Public Service Co. The computer program reduces engineering cost by 5 to 1 due to the ability of the computer to duplicate spotting of towers calculated by hand methods at the rate of 30 per mile.



GRAPH shows wherein 4-kv distribution is more expensive to utility than 12 kv or 480/832-v for primary underground service to residential customers

Right-of-way requirements need not be disclosed until the most economical route has been selected, a minimum number of ground survey crews are used, and a fairly accurate cost estimate can be made at low cost, he said.

Computer Uses Cited

Use of a computer in transmission line design can be justified economically and will enable the design engineer and draftsman to devote more time to non-mathematical requirements, said M. L. Brown, Southern California Edison Co. After selection of the route and plotting of the profile, all phases of design are calculated by computer at SoCal Edison except that the towers are located with sag templates on the profile.

Bundled conductors will play an increasingly important part in the construction of EHV lines, said R. E. Campbell, Alcoa. As voltage levels increase, special attention must be given to construction procedure.

Sag matching problems make it advisable to match old conductor with old conductor for increasing capacity of an existing line. If a line is to be built that may later be bundled, it is desirable to prestress the conductor during installation, as well as conductors that are added later, said Campbell.

Connector design has a very significant effect upon the generation of radio noise, said K. A. Fleck, Anderson Electric Corp. A study of the surface gradient and gradient distribution reveals eight design

variables which affect interference level. Laboratory tests indicate that an abrupt increase from background noise level for various types of connectors begins at different voltages between 300 and 400 kv, he said.

Noise Discussed

Control of noise from substations is generally less expensive by external means than through low-noise-level transformers. As noise in any residential situation is unpredictable and the reaction of individuals variable, "a wait-and-see, then cure" approach is most practical. But consideration should be given to later requirement of a barrier after the transformer is installed, said S. R. Lindgren, Allis Chalmers Mfg Co.

A better regulated voltage can be provided to customers at essentially no cost increase by using optimized control settings on suitable regulating equipment, said M. J. Gangel and E. E. Wejman, General Electric Co. Simulation of regulator operating details in an analog computer indicates that the best quality of regulated voltage is obtained with the smallest bandwidth. The number of regulator operations is effectively controlled by time delay. Increasing time delay to control operations does not noticeably affect voltage quality, they added.

Aluminum Desirable

Structural aluminum shapes used to erect a substation have proved desirable in all respects, said N. E. Weber, SoCal Edison. The saving anticipated in erection of aluminum structures, however, was not achieved primarily because the amount of equipment and field bolting is the same as for galvanized steel.

Cost savings on aluminum conductors and fittings installed at the substation appear to be significant, said H. E. Jordan, SoCal Edison. Elimination of bolted, clamp-type terminals for the cable conductors reduces or eliminates cold flow, bolt relaxation, and corrosion of conductors such as occur in bolted clamps on aluminum conductors. Jordan recommended that other utilities experiment with all-aluminum construction.

Although it is too early to give any operating experience with compact vs conventional cars, most cars purchased for SoCal Edison will be compact models, said N. J. McKenzie. Purchases may be as high as 90%. A small percentage of normal-sized vehicles may be needed for mountainous and off-highway operation, but compact models are universally accepted, he said.

Comments by those in attendance indicated that gas mileage for general use averaged 20 to 22 miles per gal, and that some utilities find the automatic transmission more economical than a standard shift. The compact models are easier to park, but less comfortable on long trips and have less cargo space.

By converting automotive maintenance repair records to IBM cards, periodic reports can be issued to management and shop personnel on 5,500 vehicles, said W. R. Pugh and J. B. Hicks, Pacific Gas & Electric Co. Recurring problems with certain vehicles are readily apparent and useful data of various types can be obtained quickly.

Vehicle maintenance units classified by type of vehicle and service were recently established by San Diego Gas & Electric Co, said D. K. Madison.

Flux Canceled

A radically new solution to the heating problem in metallic materials near a conductor has been developed on the basis that current flowing in one direction in a conductor and the opposite direction in its enclosures results essentially in no external flux, said A. H. Powell, General Electric Co. By connecting the ends of the enclosures of a high-current, 3-phase bus together and by properly proportioning enclosure diameter and thickness, it has been found possible to obtain up to 90% external flux cancellation. The first isolated-phase bus based on this principle has been shipped, said Powell. Tests indicated the flux reduction eliminated practically all heating and power loss in adjacent metal members.

Substitution of first-stage steam turbine pressure for measurement of steam flow is enough for control purposes and much easier to accomplish, said O. H. Hedrick and R. G. Tomkins, Fluor Corp. Advantages of this method include: Lower first cost through elimination of the steam flow nozzle and costly meter installation; a flow assembly easy to remove for recalibration and inspection; use of piezometer rings to reduce necessary straight run of pipe before the flow nozzle; and, assurance of an accurate rating based on experimentally proved data rather than a calculated flow coefficient.

The first of a series of new publications giving the revised ASME power test code will be available soon, announced N. R. Deming, Westinghouse Electric Corp. It will be concerned with acceptance tests only and will describe procedures for the tests when comparison of test results with a guarantee are to be made. Modern measuring instruments are required to minimize in accuracy.

Defects Show

After only two months operation, defects showed up in the 13% chrome turbine runners at the Balch & Haas high-head hydro plants, said P. B. Dawson Jr, Pelton Division, Baldwin-Lima-Hamilton Corp. Integrally cast in Switzerland, the 13% chrome material was expected to resist sand abrasion twice as well as mild carbon steel and prove most suitable in service.

At the rated speed of 400 rpm, each bucket is subjected to 100,000,000 stress alternations each month, the normal fatigue test limit.

A representative of the Swiss foundry worked with the turbine manufacturer's crew and PG&E personnel to develop a procedure for field repairs. While PG&E experience with the 13% chrome wheels is brief, tentative conclusions have been reached:

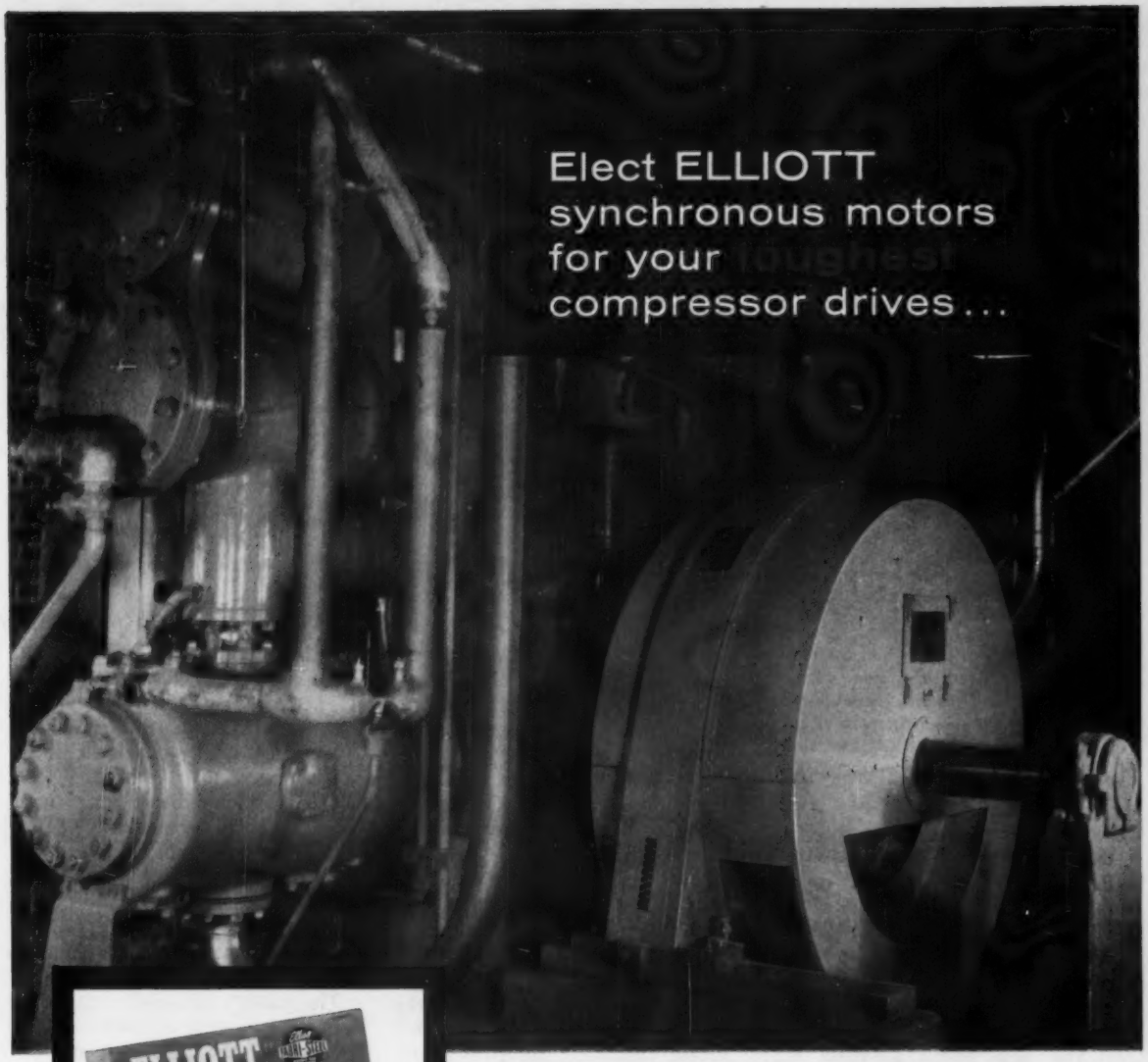
1. Where water carries much abrasive materials, 13% chrome should be carefully evaluated against cast mild carbon steel or cast nickel steel.

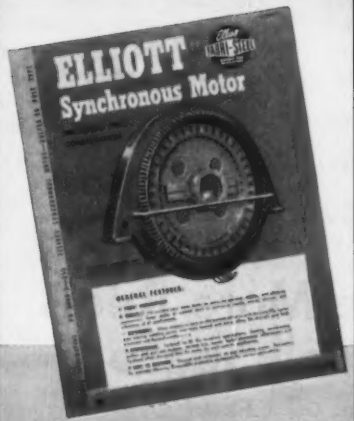
2. Minor welding repairs can be made in the field.

3. Major defects or cracks in wheels can best be repaired in a shop where work can be positioned and higher stress-relieving temperatures obtained.

4. Interior bucket surfaces must be ground smooth and polished.

5. Handling, alloying, and casting can be further improved. Investigation has shown that surface problems are common to about 50% of large wheel castings.





Call the Elliott man
at your nearby Elliott District Office
or write Elliott Company,
Ridgway Division, Ridgway, Pa.
Ask for Bulletin PB 5000-2

They're "tailored" to fit your specific application requirements

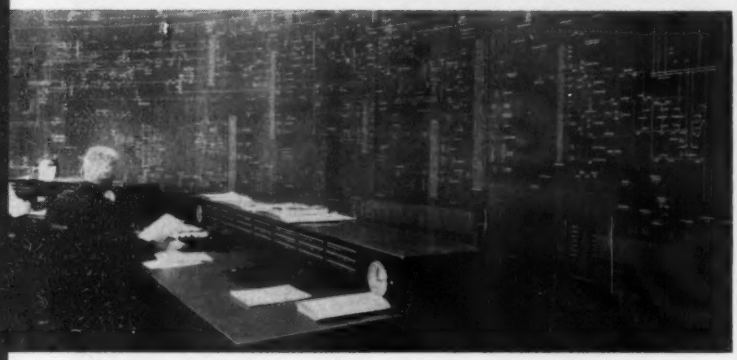
This Elliott 400-hp, 327-rpm synchronous motor is one of two machines which drives soot blower compressors for a large midwest utility generating station. Here is another example of Elliott-engineered large motors handling "tough" compressor drives *with the greatest economy and long-term, superior performance.*

Two principal reasons for their outstanding performance are the rigid fabricated steel construction, and the high-quality coil insulation. Each coil is hand-wrapped with Mylar-backed mica to withstand severe temperatures and provide long, trouble-free life. What's more, all Elliott synchronous motors are "tailored" *throughout* to meet your exact application requirements.

ELLIOTT Company
Ridgway Division, Ridgway, Pa.

R7-23

Electric Utility Methods
CONSTRUCTION • OPERATION • MAINTENANCE



New Design Eases Board Changes

W. H. FULLER, Assistant Chief System Supervisor Electrical System Dept, **K. T. GEERING**, Sign and Model Supervisor, Engineering Services Dept, Detroit Edison Co, Detroit, Mich.

A new diagram board at Detroit Edison Co has a porcelain finish that should prove impervious to most commonly used solvents and to rubbing. The method of labeling is far superior to that of using individual letters. Initial cost of the board was low and upkeep should be negligible.

The new board provides a completely new layout of Detroit Edison's system diagram in the system supervisor's office. A new installation was necessary because system growth had congested the old diagram, making it difficult to read quickly and accurately. The new diagram layout was developed for the same board area and also provides space for additions through the next five years.

Before the old board was replaced, the Research Dept investigated available materials and found a cloth tape that was stable, not glossy, and was easily removable. For the background surface of the panels, they suggested steel finished with fired-on porcelain enamel. A local porcelain enameling company produced a panel with a flat matte finish in a pleasant green.

The 2½x12-ft finished panels each consists of a front panel with its porcelain finish and a back panel of galvanized steel. The space between contains a heavy kraft paper honeycomb bonded to the panels with a thermo-setting plastic. The panels are extremely strong, rigid and "dead" acoustically. The local company fabricated and installed the panels.

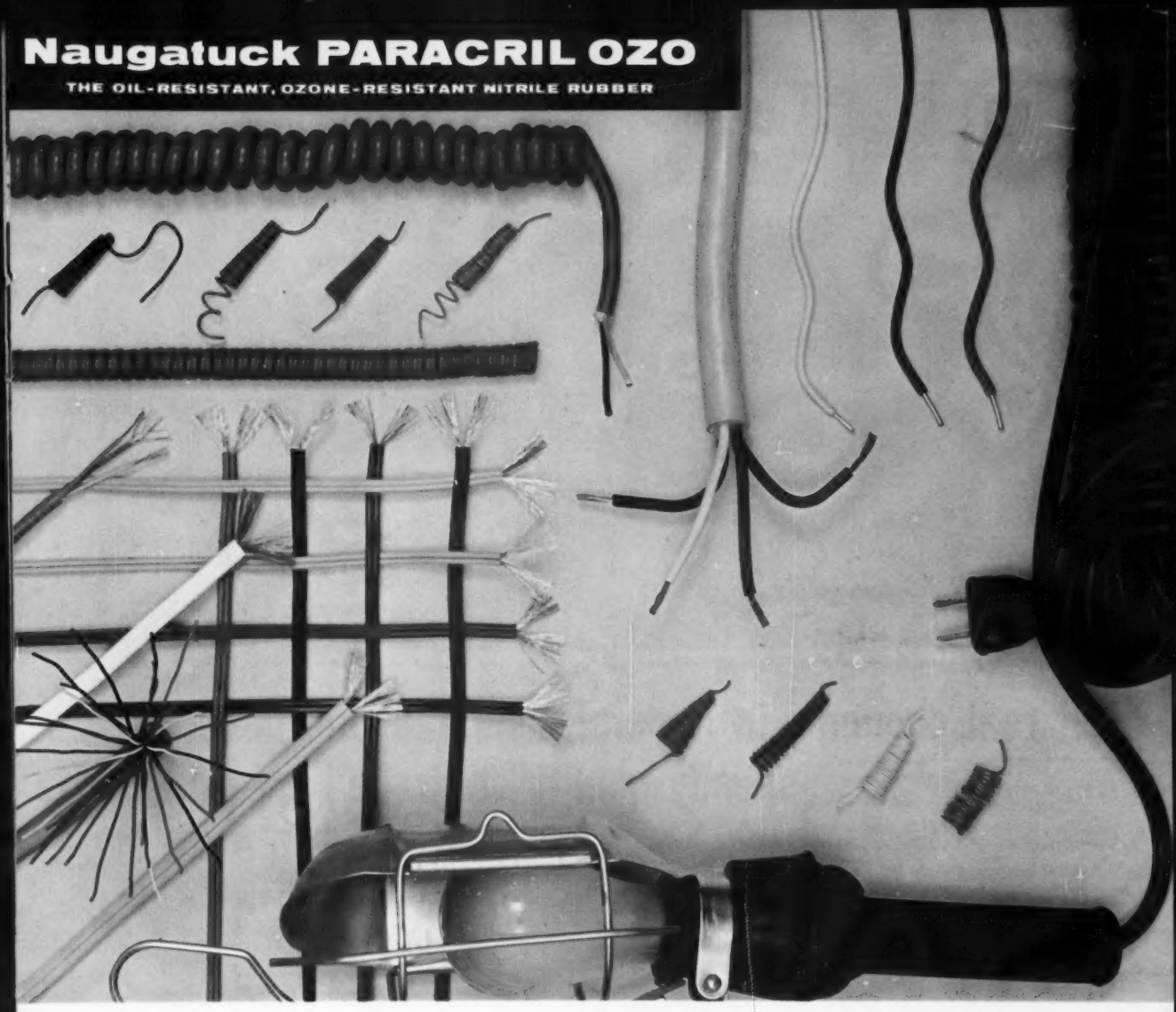
The Graphic Arts Division developed a technique of printing white letters on a transparent material with an adhesive backing. These labels are easy to read and present a good appearance. In addition, the entire name or identifying numeral of a component can be applied in one piece, obviating the handling of individual letters.

Store More Reels In Small Space

Oklahoma Gas & Electric Co is storing more wire and cable in a small space by stacking reels on their sides and one on top of the other. To make this type of storage possible, and to ease handling and storing of reels, four 4-in. spacer blocks are placed under each reel. Thus it is easy to put reels in storage or take them out with a fork lift truck. Reels can be stacked as high as the fork lift truck can lift them. They normally are stored four reels to a stack.

Naugatuck PARACRIL OZO

THE OIL-RESISTANT, OZONE-RESISTANT NITRILE RUBBER



Great new advance in wire jacket rubber

Now you can give your wire and cable jacketing new resistance to cuts and abrasion, superior resistance to attack by oils and solvents, outstanding new resistance to weather and ozone . . . *and enjoy all the benefits of color, too.*

Color code for fast, unerring identification . . . color for smart, modern appearance . . . to call attention . . . to hide . . . to add solid new sales appeal. Because PARACRIL® OZO takes and retains any color you desire, permanently.

In addition to color, PARACRIL OZO offers such advantages as:

- significantly superior ozone resistance
- excellent resistance to fuels, oils, and solvents
- exceptional abrasion resistance
- high physical properties
- good flame resistance

Try new PARACRIL OZO. See why it offers makers and users of not only wire and cable jackets, but of rubber products by the hundreds a host of valuable new selling possibilities. For more information, for samples, for technical assistance with a present or proposed application, contact your Naugatuck representative or the address below today.

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Rubber Chemicals · Synthetic Rubber · Plastics · Agricultural Chemicals · Reclaimed Rubber · Latices · CANADA: Naugatuck Chemicals Division, Dominion Rubber Co., Ltd., Elmira, Ontario · CABLE: Rubexport, N.Y.

100% inspection of *MegopaK* thermocouples insures strict adherence to factory standards. Manufacturing area is clean, dry, air-conditioned.

Get real economy in mineral-insulated thermocouples . . . specify quality-controlled *MegopaK*

Careful quality control often spells the difference between *real* economy and just another bargain. In small-diameter, mineral-insulated thermocouples, where the art of production is as critical as the science, strict quality control is your only assurance of consistent quality and real economy.

For more information on quality-controlled *MegopaK*, write for Catalog and Price List G100-4 . . . or call your nearest Honeywell field engineer.

Honeywell

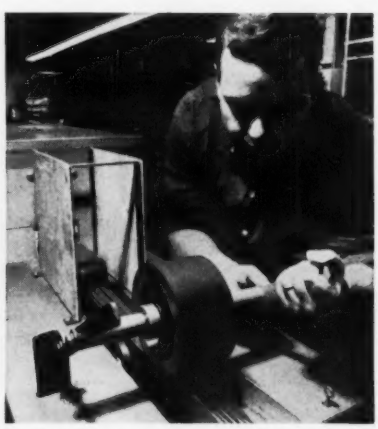
First in Control

SINCE 1885

75th YEAR — PIONEERING THE FUTURE

Insulators are stored in paraffin-sealed boxes, then baked to remove last trace of moisture. Assemblers wear gloves to prevent contamination of thermocouples.

Single-pass swaging of carefully-sized wire-insulator-sheath assembly produces no distortion in wire, insures greater accuracy and longer life.



Continuous hydrogen-annealing not only produces a ductile, brightly finished product, but also identifies improperly compacted material which is rejected during inspection.

LBE 1961 Program Gets New Approach

Battle with competition to be stressed next year with introduction of word "flameless"; only key appliances promoted

The Live Better Electrically Program will get a new approach in 1961. Also the word "flameless" will be the key word in this campaign.

Focal point of the program will be a new copy platform for advertising which has been adopted and approved by the program's planning committee and policy group. It says:

1. Be sharply competitive with other fuels. Do this by exploiting the exclusive benefits which stem from the fact that electricity is flameless.

2. Persuade women that they will increase their stature as smart homemakers in the eyes of their husbands by using electric appliances.

3. Project a picture of all members of the family living better electrically.

4. Give prominent and consistent display value to the theme line, "You Live Better Electrically."

The program has also adopted a "Statement of Policy." It states: "The objective of the LBE program is to sell more residential kwhr by featuring specific competitive equipment with the total electric living concept."

Sell Benefits of Electricity

Other objectives are:

1. To create customer preference for electrical use that is directly competitive with other fuels. This means selling the benefits of electricity, and, with honesty and good taste, calling attention to the advantages of electricity as compared with its competitors.

2. Concentrate this effort on the most critically competitive subjects: Ranges, water heaters, dryers, heating and cooling, and the Medallion Home.

3. Blend Housepower and lighting into the advertising wherever possible.

4. Coordinate national advertising with the local selling effort.

5. Encourage cooperative effort by other electrical industry members.

LBE Program manager Ralph Zeuthen said that the word "flameless" will be stressed in next year's campaign. In researching the term he said it was discovered that "consumers do not expect much more of the gas industry except the flame. However, when it comes to electricity they have the notion the elimination of the flame and the introduction of the heating element in the electric range is an advance over that." He urged manufacturers and utilities to use the word "flameless" in all advertising.

There are, however, five challenges for the future, Zeuthen noted.

- There must be industry mindedness behind the Live Better Electrically Program.
- Unification of the program, the manufacturers, and the utilities behind the same basic program.
- A pre-conditioning job to enable everyone to understand what the national program can and can't do.
- Nighttime television when money is available "to do this right."
- A field force to implement the program locally.

Eleven Utilities Cop EEI Sales Promotion Awards

Eleven electric utilities walked away with the Edison Electric Institute Sales Promotion Awards at the recent EEI Sales Conference.

Winners in the Residential Market were Houston Lighting & Power Co, Kansas Gas & Electric Co, and Weymouth Light & Power Co. Commercial Market recipients were Texas Power & Light Co, Merrimack-Essex Electric Co, and Suburban Electric Co. Philadelphia Electric Co, Jersey Central Power & Light Co, and Suburban Electric Co received awards for sales promotion excellence in the Industrial Market. Ohio Power Co, Kentucky Utilities Co, and Dayton Power & Light Co were given Farm Market Awards.

In the photo, H. J. Sowders, (right) supervisor, rural sales department, Dayton Power & Light Co, accepts the award for his company from A. M. Wade, chairman of the Awards Committee.

Procurement & Products

COURTS ▶ **Supreme Court grand jury in Canada indicts** Ontario Electrical Contractors' Assn and its president on charges of conspiring to lessen competition in sale of heavy electrical equipment and material in Ontario. The indictment is based on a report which accused the association of attempting to funnel all electrical supplies for construction jobs through electrical contractors.

In Philadelphia, sentencing is set for May 16 for the two electrical manufacturers and three individuals who have entered guilty pleas in connection with two antitrust indictments.

ACCEPTANCE ▶ **Rural Electrification Administration has approved GE's** Magne-Valve distribution arrester after three successful years of trial use. The arresters offer a 100,000 amp, high current, short-duration discharge capacity for protecting all types of distribution equipment.

COAL ▶ **TVA checks coal deliveries with steel sampling tube.** The tube is driven into a truck-load of coal with an air-operated pilehammer to obtain a quick cross-section of what the load contains. Several coal operators lost contracts with TVA last December when TVA said they were making fraudulent deliveries. TVA said some truckers were delivering waste coal after covering it with a layer of top-grade coal. TVA has been using a rented pilehammer for its sampling, but now wants to buy one for permanent use.

PRICES ▶ **Sangamo Electric Co has announced a 10% increase** in the selling price of paper and plastic film capacitors, mica capacitors of all types, and electrolytic capacitors. Not affected are energy storage electrolytic capacitors and some categories of motor start electrolytics. C. H. Lanphier, president of Sangamo, said increases were long overdue.

Subox, Inc, manufacturers of protective paints, offers increase in discount quantity purchases, which it says, largely offsets the gallon price increases, and in some cases, makes the cost of many products even less than they were in prior years.

COPPER ▶ **Copper remained at 33¢ a lb** as of early last week, with purchases rising to the highest since the week of March 9. Pricings outside the country also rose—leading some observers to conclude there might be no nearby oversupply of copper in the U. S.

ACQUISITION ▶ **Superior Cable Corp acquires Supa Insulations, Inc,** and will operate it as a wholly-owned subsidiary. Supa specializes in Teflon-insulated wire and cable.

News of Manufacturers . . . . . page 78
New Equipment . . . . . page 91
Readers Service . . . . . page 92

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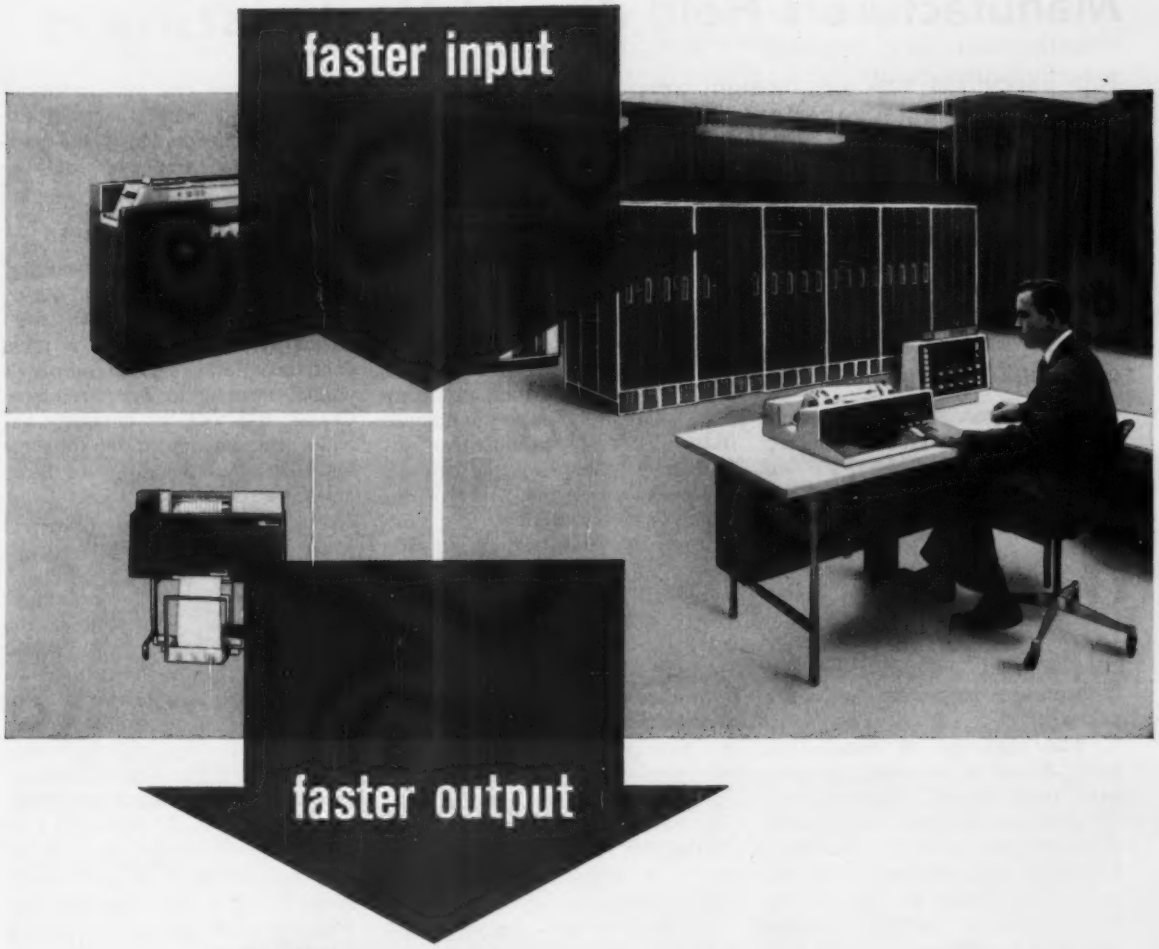

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For full information on the new tape-oriented 7070 call your IBM representative. Like all IBM equipment, the 7070 System may be either purchased or leased.

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Manufacturers Hold Annual Meetings

Top executives talk on foreign competition, low prices, foreign 'sourcing' and an upswing in new orders

With spring come the robin and stockholders' meetings. This year's meetings were no different in most respects than last year's. But in a few, some vital new things were said during and after the meetings. Here are excerpts:

Competition Is GE's Theme

Competitive vigor is a major area of opportunity for General Electric Co in the years ahead, President Robert Paxton told GE stockholders at the company's 68th annual meeting held in Chicago April 27. "Competition of course has been a primary instigator of beneficial change throughout our history," Paxton said. "It penalizes those who are complacent or unproductive while it encourages innovation and better values.

"The challenge of competition from abroad is becoming progressively more intense," Paxton noted. "Foreign manufacturers, often with their modern facilities combined with labor and overhead costs far below such costs in the United States, have the means to provide tough competition not only in foreign markets but in this country as well."

As answers to that challenge, Paxton cited accelerated innovation and emphasis on better customer values, as well as more efficient manufacturing methods to reduce costs.

"We also have a highly competitive management," he said. "Our insistence on competitiveness was confirmed by our quick action last year when there was a violation of a long-standing, written company policy that prohibits any employee from discussing competitive information with any representative of another company. Your company condemns all restrictive practices and its determination to pursue a policy of creative, aggressive competition is especially visible in the efforts it is making in the international market.

"Now we need to remember that, if foreign producers are enlarging their shares of the internal market as I have pointed out, they are also becoming more affluent and providing richer markets," Paxton said. "During the past few years," he pointed out, "plans have been completed for substantial improvement and expansion of our manufacturing operations abroad to serve foreign markets." Paxton referred to GE plants and investments in electrical manufacturing companies in Argentina, Brazil, Mexico, Italy, Germany, and Japan.

Paxton said that 1960 marks the start of a new era with enormous potential, but warned against expecting the momentum of the postwar years to carry over into the Sixties.

Westinghouse Reduces Costs

Possibility of 'foreign sourcing' of components was not ruled out by Westinghouse President Mark W. Cresap Jr. Speaking at a press conference following the company's annual meeting in San Francisco, Cresap said that the company has had a program in operation for some time to reduce costs and make prices more competitive with those of foreign manufacturers.

The most recent problems of competition would accelerate efforts in this direction, he pointed out. Since labor is a large proportion of the costs of many products, Cresap said he hoped that most items the company manufactures could be continued to be manufactured in this country. But continual pressure from foreign sources could result in some component items being made abroad in the future. Although economics may force this decision, he said, this would be a most unfortunate trend for American labor and would certainly be against present company policy.

At the meeting, Cresap said, "Westinghouse is expanding vigorously, but it is also expanding selectively. In our view, expansion has

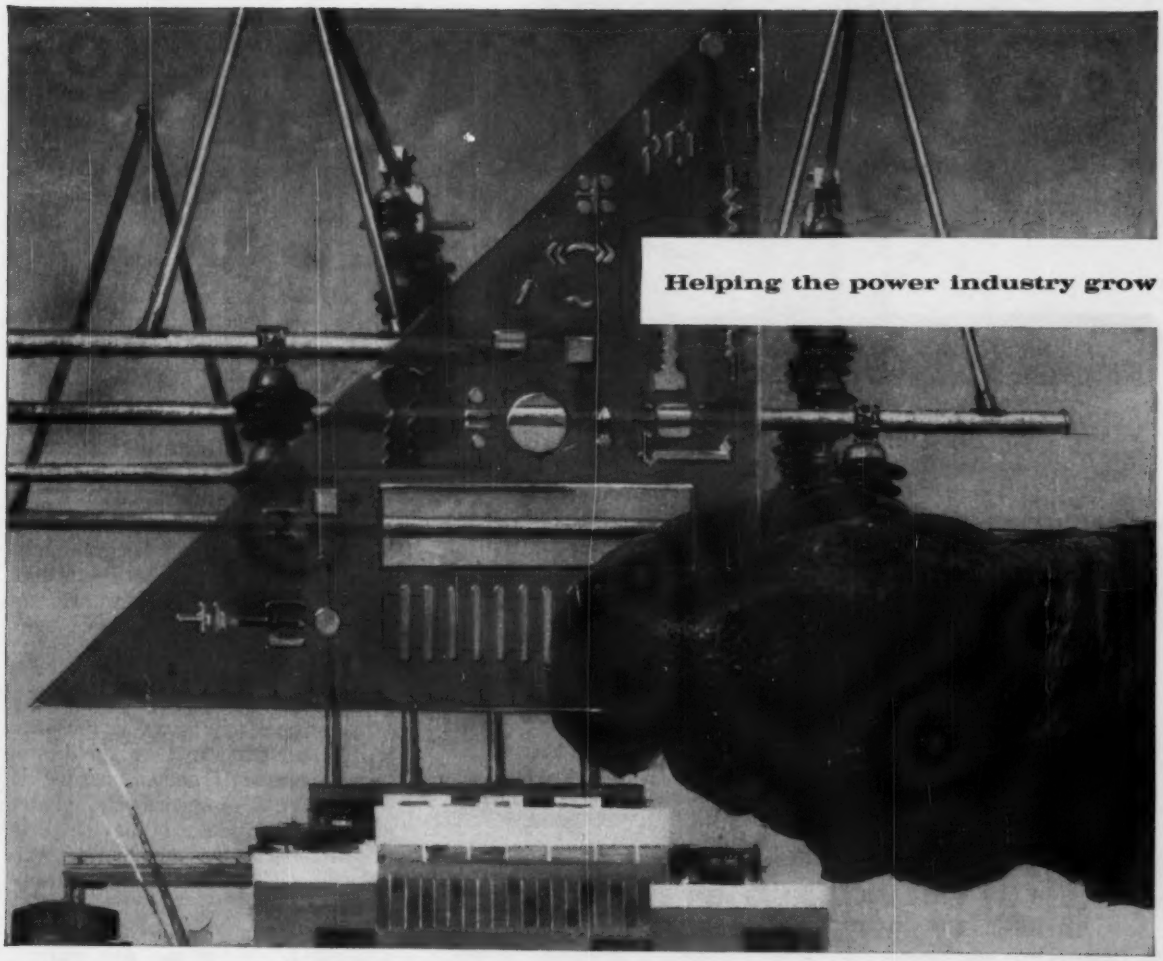
(*Continued on page* 80)

I-T-E's Scott | B&W's Nielsen | WE's Cresap | GE's Paxton | CE's Santry

Hand of a craftsman

The hand of a craftsman grasps a template used by engineers and designers in translating design; in the background an intricate power installation nears completion. United Engineers has served pace-setting utilities and industrial organizations on such projects as thermal and hydroelectric plants, electric substations, and installations for supplying heating and process steam. Each presented its own technical problems—each was successfully solved on schedule and within estimate. Our skills and creativity can augment your engineering staff as required. Our background of 75 years' experience as designers, construction engineers, and engineering consultants can pay you substantial dividends.

Painting by Stanley Meltzoff



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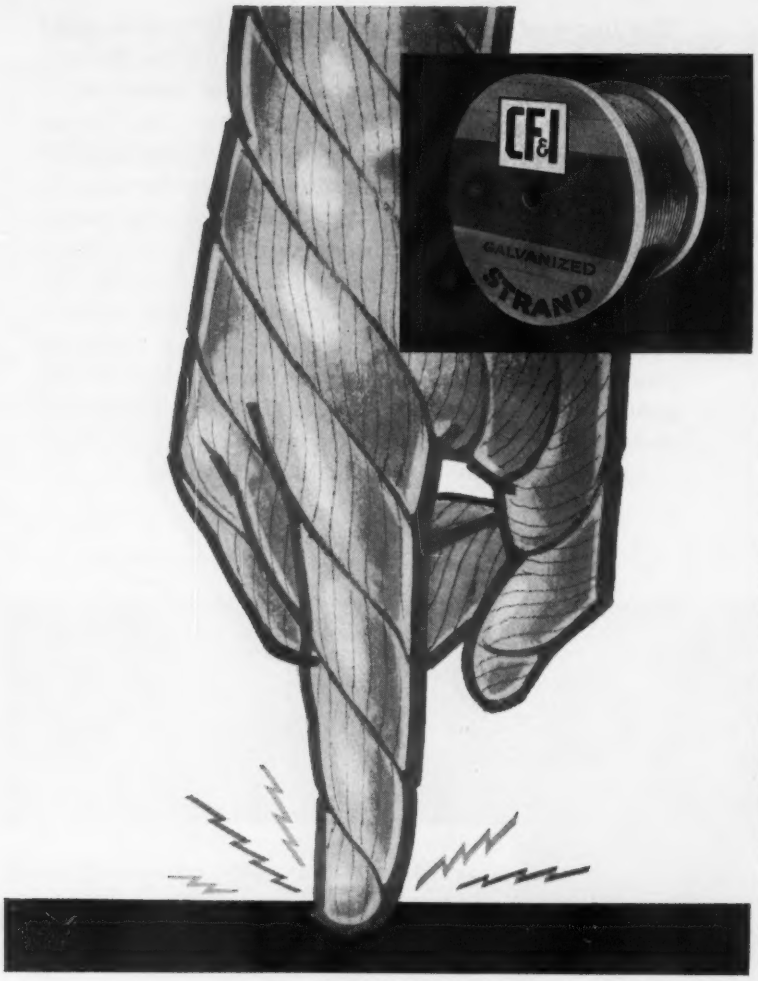

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(*Continued from page* 78)

little appeal unless it promises to contribute to the company's profitable growth." The management of Westinghouse, he said, "is dedicated to improving profit margins and returns on assets not modestly, but substantially," in the next two or three years.

I-T-E Pessimistic

I-T-E Circuit Breaker Co's President W. M. Scott Jr told about 30 shareholders at the company's annual meeting in Philadelphia April 26 that prices of heavy electrical equipment are in "complete chaos, running 25% to 30% less than in 1957. Quite frankly, prices for heavy electrical equipment are as bad as the 'white sale' in 1955," Scott said.

This gloomy picture was further heightened by indications that the company would barely break even in the first quarter of this year. Last year's first quarter profits were only $47,000. Scott pointed out that the first quarter is "always burdensome" and said he was somewhat pessimistic about profits for the next several quarters.

CE Has Highest Backlog

Boiler sales upturn to begin late this year and continue through 1962 is predicted by Combustion Engineering, Inc, Chairman Joseph V. Santry. Speaking at the company's annual meeting in New York, Santry predicted increased sales and earnings during the coming years. Present backlog, at about $390-million, is the largest the company has ever had. But shipments of most of these orders will not begin until late this year and therefore will not be reflected in the current year's performance, Santry said.

B&W Says Buying Cycle Lags

Babcock & Wilcox Co's President Morris Nielsen told stockholders at the company's annual meeting in New York of record first quarter earnings despite a 90-day strike at the tubular division plant in Alliance, Ohio. Nielsen said consolidated orders for April are coming in at a rate almost double the monthly rate of the first quarter, with these orders coming mainly from large public utilities.

After the meeting, spokesmen

(*Continued on page* 82)

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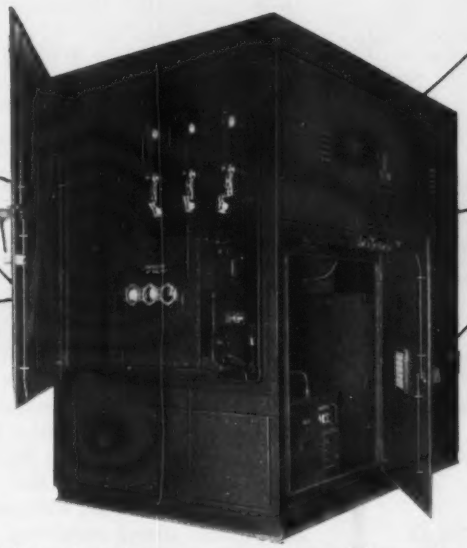

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(*Continued from page* 80)

said the utilities' buying cycle appears to be lagging six to nine months behind what might have been expected. Possible reasons cited for the lag were the steel strike and the memory of the 1958 recession. Therefore, despite the pick-up in April orders, the spokesmen felt it was too early to determine any buying trend by the utilities.

First-Quarter Earnings Reported by Suppliers

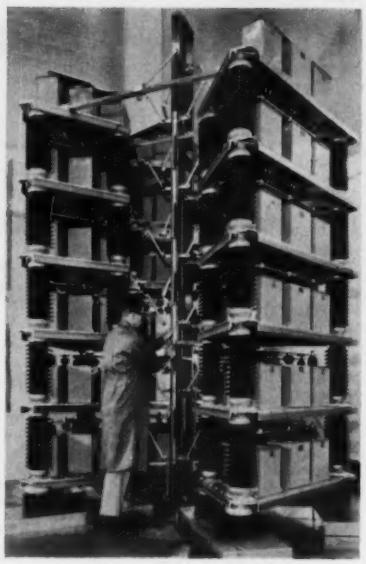
General Electric reported net earnings for the first quarter of 1960 were $52,614,000, or 60¢ a share, almost identical to first-quarter 1959 net. Sales totaled $957,433,000, down 2% from sales in the first quarter last year. Outlook for remainder of year is regarded by Board Chairman Ralph J. Cordiner as "potentially favorable," based on 9% gain in total orders so far for all types of products.

Westinghouse realized 35% increase in net income in the first quarter this year, or $19,496,000, on billings of $458,817,000, 4% higher than for similar period in 1959. Net income equal to 55¢ a common share was second highest the company ever reported for a first quarter and compared to 41¢ a common share a year ago. Net sales billed were also the second highest for a first quarter. President Mark W. Cresap Jr pointed out that new orders booked increased 20% over the first quarter 1959, with each of the product groups registering gains in new business.

Allis-Chalmer's first-quarter earnings of $2,645,273 on sales of $126,392,931 were "below expectations." President R. S. Stevenson says farm equipment and construction machinery sales got off to a slow start; however, shipments of other product lines have been up to schedule and export sales have improved markedly.

General Cable's net earnings were about 25% higher in the first quarter of 1960 than in the first quarter of 1959, running between 70¢ and 75¢ a share. However, J. R. MacDonald, chairman and president, expressed optimism about his earlier prediction that earnings for 1960 could run about $3.50 a share (compared to $2.71 last year). The company has started operations at two new plants and expects these additions to "be in the black within a few months." Extensive additional expansion will be completed later this year.

Square D's first quarter earnings, $2, 817,112, approximately doubled comparable 1959 earnings. Sales of the company's distribution and control products for the period were $27,585,950, over 21% greater than in similar period in 1959. This was attributed to efficiency of new plants.



300-Kv Testing Generator Designed by Joslyn

Joslyn Mfg & Supply Co has designed and fabricated a 300-kv generator for surge-current testing. The 300-kv output voltage was chosen to permit discharge current testing of complete valve-type arresters without resorting to testing partial sections. It tests lightning protective devices and also serves as the initiating generator for duty cycle or power-follow tests. On short circuit it will deliver 90,000 and 125,000 amp crest on 300 or 150 kv, respectively, with waveforms of 5x10 and 9x15 μsec.

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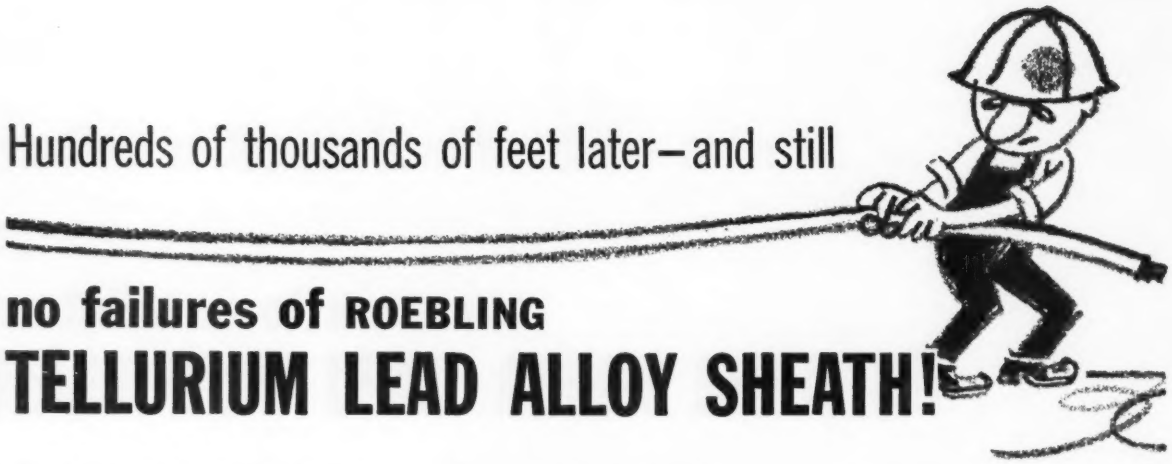

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These graphs of laboratory tests show effect of aging on tensile properties of Tellurium Lead Alloy Sheath.

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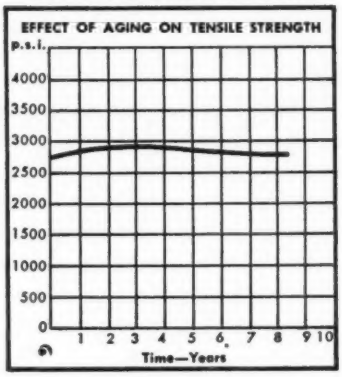

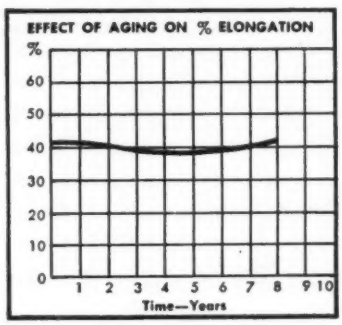

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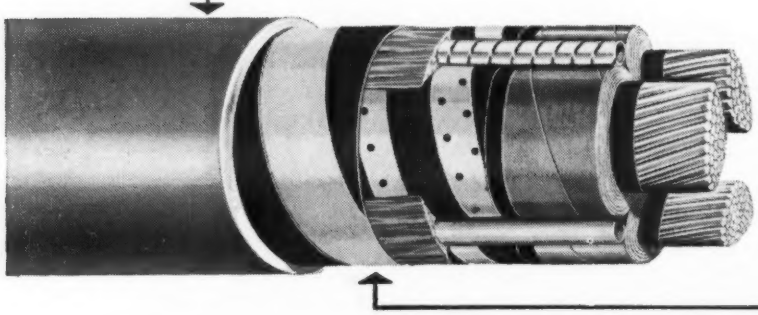

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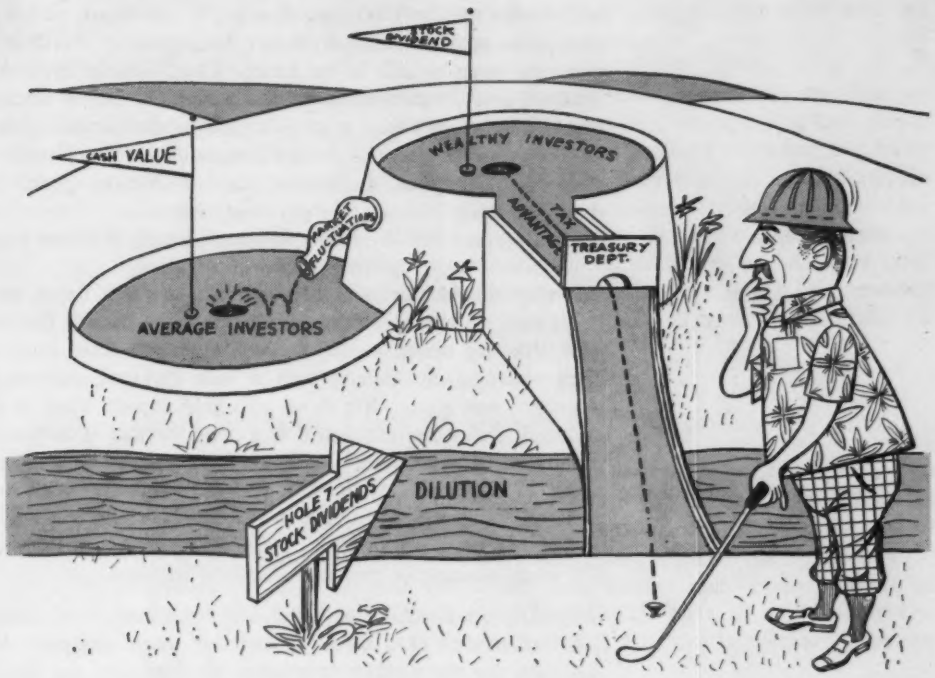


Who Should Pay Stock Dividends?

Report on
Finance

Only a smattering of electric utilities could be counted amongst the 1,000-plus U. S. corporations that paid stock dividends in 1959. Were most utilities wise in sticking to cash dividends alone? That depends on the company. For the briskly-expanding utility, stock dividends supply extra retained earnings to nourish the business. But for the average utility, they can actually feed more earnings into the business than it can use profitably. What should a company do?

Unlike industrial earnings, utility earnings are fairly stable; the utilities can pay maximum, regular cash dividends. The industrials, on the other hand, favor smaller, regular cash dividends, which they can follow up at year-end with an "extra"—often, as last year, in stock. Very few industrials, though, pay stock dividends regularly, throughout the year. But this pattern doesn't apply in the utilities, where special, year-end dividends are the exception. Thus, stock dividends, if paid at all, are likely to be combined with cash dividends on a regular, quarterly basis. But is the game worth the gamble? From the distance, stock dividends appear to offer many advantages, especially in cutting costs of raising new equity by supplying it internally instead of through the market. Here, the savings could run to about 4% of the amount involved. But a closer look reveals many disadvantages, too.

The most important, single disadvantage is the reaction of the stockholders themselves. The vast majority prefer maximum cash dividends. Furthermore, their income generally falls in a tax bracket that doesn't plague them with substantial income tax woes. Cash dividends give them the money they want, at no trouble or expense.

In stark contrast, the wealthy stockholders don't want cash dividends at all. A wealthy stockholder in, say, an 80% top tax bracket (representing an income of about $140,000 a year for a married taxpayer) would receive $800 per year on a $20,000 utility investment that paid 4%. But after income taxes, he would be left with merely $160, less than a 1% net return on his investment. However, if he receives stock dividends, he pays only the 25% maximum capital gains tax when he sells in the future. Thus, wealthy investors favor stock dividends as a sole means of dividend distribution. These stockholders are usually few in number, but their total holdings are substantial—although generally less than the total holdings of the great mass of average investors. The third large class of stockholders, the institutionals, all receive special tax concessions on their investment income; they pay only token taxes, or none at all. The taxability of cash versus stock dividends, therefore, hardly concerns them.

But why should the mass of small stockholders frown on stock dividends? Can't they sell the stock they receive and get cash if they want it? To begin with, the very smallest investors would never receive stock dividends anyhow. They would always receive cash if their dividend amounted to less than the price of a new share. But those who hold enough stock to receive one or two dividend shares can only sell it at a price sacrifice if they want cash—and they usually do. The problem is their small holdings. The average stockholder owns about $7,000 worth of stock in a given company. With an assumed average price of about $35 per share, a 4% return would yield him $1.40 per year, or 35¢ per share per quarter. Thus, the average investor would receive about $70 each quarter, or two new dividend shares.

If he sells his stock, he pays the 6% New York Stock Exchange commission (on transactions of $100 or less). But many common stocks aren't listed, especially for the smaller companies. In that case, the dividend shares would have to be sold over-the-counter, and the combined commissions and "spread" (difference between bid and asked price) could push the cost of sale to 10%, or more. And he is put to an inconvenience in the bargain.

But inconvenience and expense are not all that ruffle the small stockholders. The stock dividend itself affects the market, as many small investors rush in to sell their dividend stock when they receive it. Thus, a considerable block of stock goes up for sale on every dividend date (perhaps as much as $720,000 per quarter for a utility with $200 million in net assets). This creates a temporary oversupply. The market is pushed down, in part because there is no orderly means of distributing the dividend shares to new investors. It's hard to say how great this drop will be, or even how serious—the "bluechips" and growth companies may have enough glamor to hold their spell over investors despite periodic fluctuations in market price.

These periodic shocks to confidence, as many as four a year, can hardly strengthen investor confidence. Furthermore, security analysts may shy away from recommending these cyclical stock-payers to many of their clients that might otherwise be interested in a utility investment. Even the wealthy investors, who hope for price appreciation, may find the ups and downs are actually retarding appreciation.

We find this impasse: stock dividends don't suit the mass of small investors, and cash dividends are distasteful to the wealthy. What can be done? The first solution that comes to mind is to simply give both types of investors what they want: Cash for the many, stock for the few. Unfortunately, there is a formidable obstacle—the Treasury Department. It says, simply, if investors have an *option,* cash *or* stock, then dividends paid in stock are taxable just as though they had been paid in cash.

On this problem, only limited headway has been made. Back in 1950, Willard

F. Stanley, then financial vp of an electric utility (and now a New York financial consultant), drew up a plan for two classes of stock. One class paid only cash dividends, the other only stock. Investors could choose what they wanted because each class was convertible into the other. But after long consideration, the plan was rejected by the Treasury on the grounds that the stock dividends were an option to the investor, thus taxable as income.

A similar plan was developed independently and presented to the Treasury about five years later by Citizens Utilities Co. This time the Treasury okayed the plan, but only shortly thereafter announced a proposed regulation that would make stock dividends taxable under just such a two-class plan. As usual, the Treasury solicited comments and suggestions from industry, and held a hearing. But several years have passed, and the regulation has been neither adopted nor withdrawn. By essentially pigeonholing it, the Treasury has deterred other companies from advancing similar plans, and at the same time it has prevented a legal test case—there is no regulation to take to court. Meanwhile, the Citizens Utilities plan goes on unmolested.

Stock Dividends Could Be Geared to Holdings

Stanley, author of the abortive 1950 plan, suggests an alternative, one not yet tried, he believes. Corporate charters could be amended, he argues, to provide alternate dividend treatment for stockholders, depending on the *amount* of their holdings. Company directors could rule, for example, that all stockholders who held less than 200 shares would receive cash dividends, while all others would receive stock. Stockholders wouldn't have an option to receive cash or stock dividends, they could only switch from one to another by increasing or decreasing their holdings.

Suppose such a plan was workable; would the wealthy stockholders bid up the price of the stock? For a clue, we can investigate the Citizens Utilities two-class stock plan. The "A" (or stock dividend) stock is convertible into the "B" (or cash dividend) stock. But cash dividend shares can never be converted to "A." The record shows that investors (presumably wealthy) have bid up the price of the "A" (stock dividend) stock substantially above the other. At mid-March, price earnings ratio of the "A" stock was 21.3, while p-e ratio of the "B" stock was only 18.5. And the "A" stock was selling for about 30% more than the average for the G. A. Saxton & Co "size group" in which Citizens Utilities falls (36 companies make up this "size group," all with gross annual operating revenues below $25 million).

Surprisingly, most of the stock (about 73% at mid-March) is in the "A" (stock dividend) class. This seems unusual, since we would expect the "B" stock to be the most popular with average investors. Apparently, the expectation of a higher price for the "A" (now realized to about 2 points) may have induced investment dealers to advise their customers, who normally would want cash dividends, to accept the "A" stock when it was offered.

Since Citizens Utilities has a dividend payout ratio of about 77%, it retains roughly 80% of its earnings each year—probably more than usually required for expansion. This has contributed to building up CU's common stock equity to about 46% of total capitalization (well over the industry's 36% average) and has probably diluted per share earnings. However, the unusually high price earnings ratio of the "A" stock seems to more than offset any earnings per share dilution, and the plan probably creates considerable additional values for the "A" stockholders.

The average investors wouldn't mind receiving stock dividends if they were easily and cheaply convertible to cash, and if they didn't exert pressure on market prices by forming an "overhang" when each dividend is paid. These

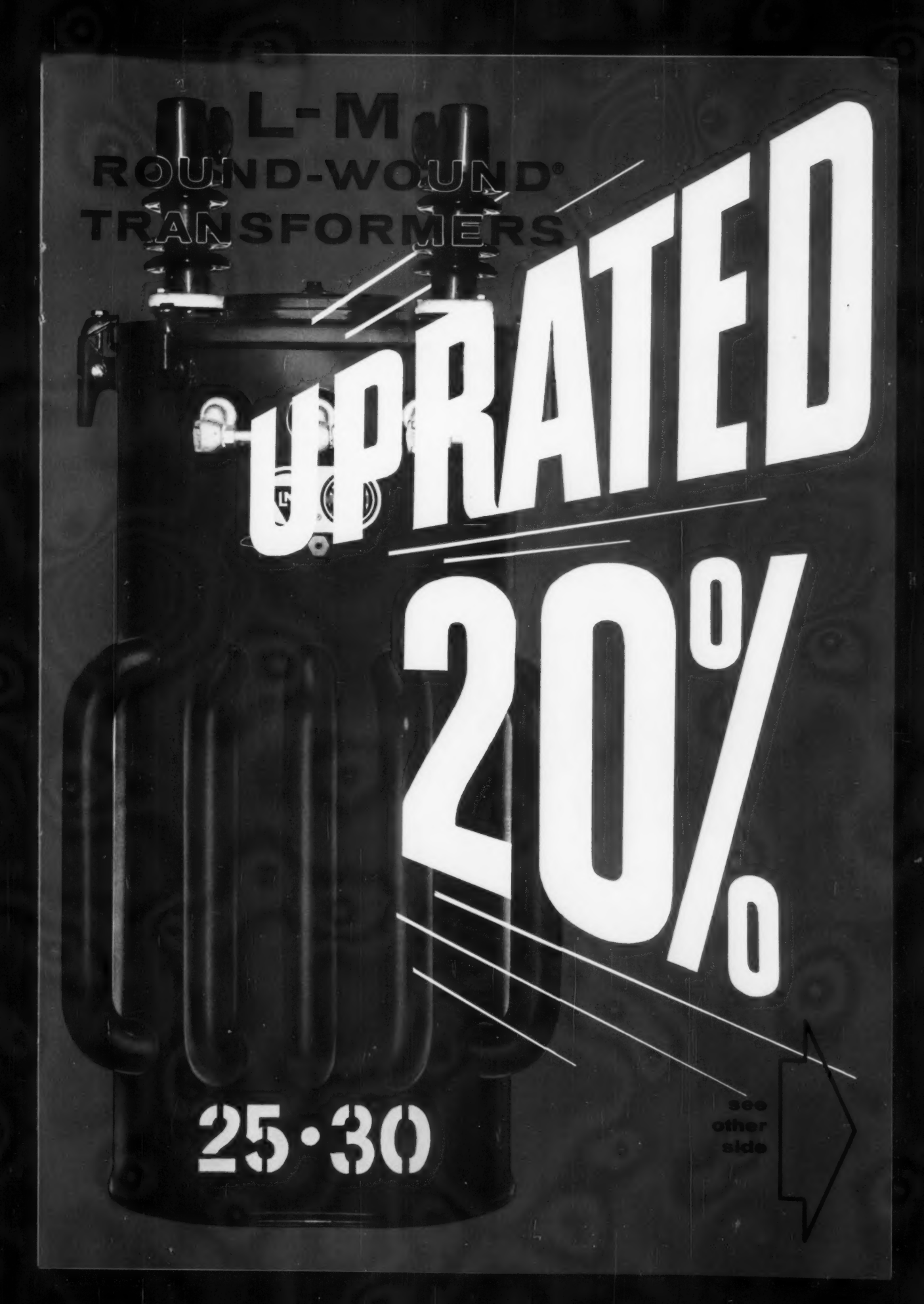
ills could be cured, Stanley believes, by forming a purchasing and selling group of underwriters and investment dealers who, each quarter, would operate in the stock. They would buy at 100-share, round lot prices (less a small commission) from the smaller stockholders wishing to sell, then distribute the stock to new investors in an orderly manner. The unwanted dividend stock would not drift into the market in helter-skelter fashion, thus eliminating the adverse "overhang." And the small investors wouldn't face such a price sacrifice when they sell.

This procedure could be simplified even further, Stanley believes, if companies were authorized to deliver quarterly stock dividends directly to the syndicate. The stockholder would automatically get his cash proceeds, less a modest commission, as long as he wished to continue selling his dividend shares on these general terms. There would be no inconvenience; he would simply receive a check from the underwriting syndicate instead of dividend shares from his company. This roughly corresponds to the Commonwealth Edison plan, in which shareholders can elect to receive cash for their supplementary stock dividends by merely checking a card and sending it to an agent-bank. It sells the dividend shares and returns the cash, less commission (EW, Sept. 15, 1958, p 87). This sort of plan could even be modified so the company would contribute to the expense of the underwriting transaction to help pare stockholders' commissions to the bone. The expense to the company would still be far less than the cost of selling new common, and should not, in Stanley's eyes, affect the tax-exemption of the stock dividends.

But none of these proposals would ease the biggest stock dividend problem of all—dilution of per share earnings. Most companies would still be selling more stock than they needed for expansion. An electric utility with $200 million in net assets, expanding 10% per year, and paying out about 70% of its earnings, could generate all its new equity capital by retaining only 50% of its cash dividends. This assumes the company has an average common equity ratio (about 36%) and wants to hold it there. If the company chose to retain all of its earnings, paying all dividends in stock, some of the funds it retained would replace debt financing, which is less costly. This would push up the overall cost of money, and push per share earnings down. And earnings dilution would tend to offset the benefits the stockholders would derive from the stock dividend policy. Of course, if the stock dividends were appealing enough to wealthy investors, they could bid the price high enough to balance these disadvantages, or even overbalance them.

What conclusions can we draw from the record? In G. A. Saxton & Co's listing of 115 electric utility stocks, only 12 companies pay dividends in stock (excluding Citizens Utilities, whose two-class plan is not directly comparable). These 12 stocks have a 16.3 average price earnings ratio. However, the weighted average p-e ratio for all stocks in the list is 17.1—about 5% higher. It is significant that eight of the 12 companies have price earnings ratios that lie below their group averages, while one company is riding the average, and only three are higher. Admittedly, it takes much more than a dividend policy to determine a price earnings ratio. But when eight companies out of 12 that pay stock dividends also have below-average price earnings ratios, it seems that stock dividends almost beg to be the villain.

Periodic payment of stock dividends appears more likely to be a liability, to the average utility and its stockholders, than an asset, with present tax laws and problems of reselling dividend shares. But while this seems a logical conclusion from the data at hand, some companies may, in fact do, fare well with stock dividends, as exemplified by the three companies above. It seems as though the challenge to the electric utility industry would be to seek out and eliminate the disadvantages to stock dividends. And finally, to use the technique to raise market prices and to save on selling new common stock.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All L-M Round-Wound Transformers, 25 kva and below, 2.4 kv through 8 kv, Issue E, now in your stock or on your lines, can be up-rated 20% over nameplate rating with no reduction of normal life expectancy. A 25 kva can be rated at 30 kva *without exceeding present ASA-NEMA standards of 65° maximum rise in winding hot-spot temperature.*

L-M Issue E Transformers rated 37½ through 75 kva, 2.4 kv through 8 kv, can be uprated 12%, and will still remain within the ASA-NEMA 65° *hot-spot* temperature rise with no reduction in normal life expectancy.

And our guarantee remains in full force.

This uprating is possible because of the excellent thermal characteristics inherent in the L-M Round-Wound design.

Ask your L-M Field Engineer for further information. He has complete details. Line Material Industries, Transformer Division, Zanesville, Ohio.

450

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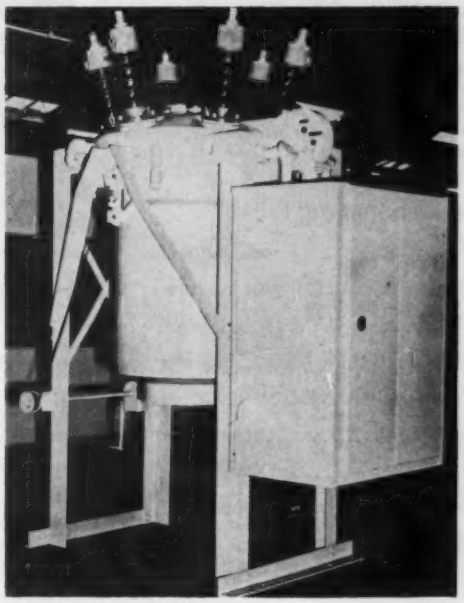
McGRAW-EDISON COMPANY

Transformers

McGRAW EDISON

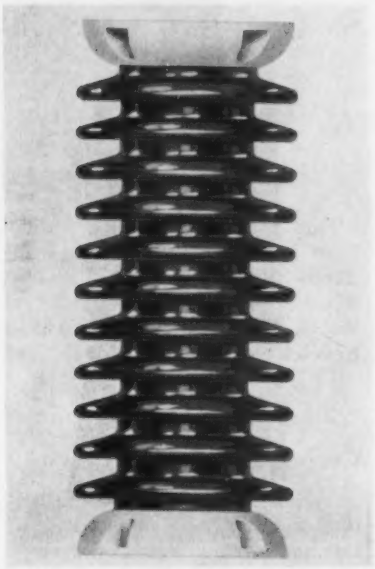
DISTRIBUTION TRANSFORMERS · RECLOSERS AND OIL SWITCHES · FUSE CUTOUTS AND FUSE LINKS · LIGHTNING ARRESTERS · POWER SWITCHING EQUIPMENT
PACKAGED SUBSTATIONS · CAPACITORS · REGULATORS · OUTDOOR LIGHTING · LINE CONSTRUCTION MATERIALS · PORCELAIN INSULATORS · FIBRE PIPE & CONDUIT

(For further information refer to Readers Service on page 92)



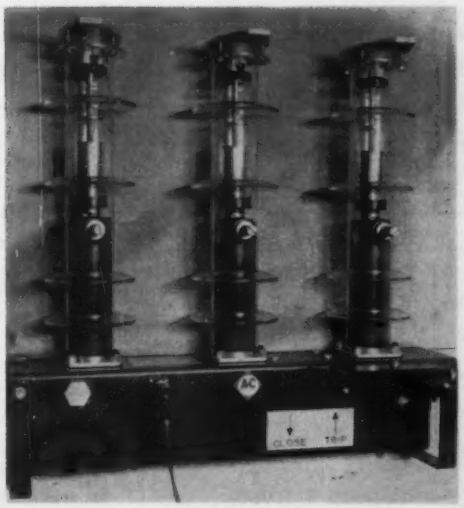
Oil Circuit Breaker . . .

. . . has a single tank for three phases. Vertical interrupters afford proper clearance; phase barriers and tank liner insure protection. Interruption is in five cycles, reclosing in twenty. Ratings are 14.4, 23, 34.5 and 46 kv, 500 to 1,500 Mva. The tank drops for easy maintenance access. The 46-kv units are 100 in. long overall, the lower-voltage units 90⅛ in.
I-T-E Circuit Breaker Co, Kelman Div, 1667 N Main St, Los Angeles 12, Calif.



Post Insulators . . .

. . . permit stacking of identical units without resort to special top, bottom or intermediate components. Since all Unipost units are interchangeable, only one type needs to be stocked for a given rating. Standard, high and extra-high strength types are offered, with a complete range of BIL's in each. All end caps are the same. Two identical mounting Uniplates, drilled and tapped to standard bolting dimensions, are furnished with each post insulator.
Ohio Brass Co, 380 N Main St, Mansfield, Ohio.



Capacitor Vacuum Switch . . .

. . . is for all-weather, outdoor application. The 3-phase, 15-kv, 300-amp switch is enclosed in an acrylic resin plastic housing. Control current can be ac or dc. The vacuum-tube switch interrupts all phases simultaneously, and its contacts will last more than 10,000 operations. Normal operation is by electric solenoid, with manual operation for emergency and maintenance. Four auxiliary contacts are standard equipment.
Allis-Chalmers Mfg Co, Milwaukee 1, Wis.

(*More New Equipment on page* 92)

Readers Service

For additional information on new products, supplies, and services in this issue, the Manufacturers Editor of Electrical World offers his facilities. Check items in which you are interested in list below:

NEW EQUIPMENT

I-T-E.....Circuit Breaker ☐
Ohio Brass.....Post Insulator ☐
Allis-Chalmers .....Switch ☐
Minneapolis-Honeywell ..Computer ☐
Wright Hoist.....Hoist ☐
Seneca Falls.....Controller ☐
W. C. Dillon.....Thermometer ☐
Westinghouse.....Crepe Paper ☐
Atlas.....Truck Loader ☐

OTHER

Manufacturers Editor
Electrical World
330 W. 42nd St.
New York 36, N.Y.

* Note: Requests must be received within four weeks of publication date, accompanied by complete information specified. This service cannot be offered to readers in foreign countries or to competitive manufacturers.

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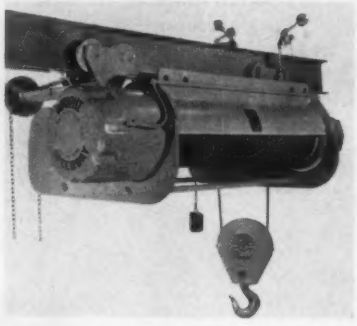
Specs ..... ☐
Trial ..... ☐
Purchase ..... ☐

MAY 9, 1960

Computer . . .

. . . in the medium-price field contains a memory of 1,024 48-bit words, which can be doubled at customer option. The Honeywell 400 is programmed with 3-address instructions. It prints 900 lines per min of 120 characters each, and skips lines at 126 lines per sec. The 400 system can be expanded to the larger Honeywell 800.
Minneapolis-Honeywell Regulator Co, Datamatic Div, Wellesley Hills 81, Mass.



Geared-Trolley Hoist . . .

. . . turns 7-ft radius curve. Speedway Frame 3 hoists six tons and has a headroom of 40 in. Lift is 115 ft and lifting speed 20 ft per min. Load-sustaining members are built with a safety factor of 5 to 1.
Wright Hoist Div, American Chain & Cable Co, Inc, York, Pa.

Motor Load Controller . . .

. . . protects against overloads through measuring kilowatts and not simply current. It actuates an alarm or shutoff relay adjustable to desired overload percentage. It operates on 110, 220 or 440 v, single or 3-phase.
Seneca Falls Machine Co, 23 Fyfe Bldg, Seneca Falls, N. Y.

Stem Thermometer . . .

. . . 6 ft long is available in ranges from 0-200F and 200-1,000F. It is also furnished with Centigrade calibration. Choice of dial sizes is 1-5/32 in. to 5 in. Accuracy is

within 1% of full-scale reading. Stem is stainless steel. Unit withstands pressures to 3,476 psi in liquid or gas.
W. C. Dillon & Co, Inc, 14620 Keswick St, Van Nuys, Calif.

Crepe Paper . . .

. . . intermediate, resin-treated, is used for forming wire guides, outside and inside protective coverings, physical supports, and similar forms. It stretches as much as 200%. Forming temperature at 50-100 psi is 125C. It is supplied in 30, 40 and 60-in. widths, untrimmed.
Westinghouse Electric Corp, Micarta Div, Trafford, Pa.

Truck Loader . . .

. . . is operated by one man electrically from either floor or platform. The Atlas "One-Man" Truck Loader has capacities to three tons and a lift of 25 ft. It moves on retractable casters.
Atlas Industrial Corp, 849 39th St, Brooklyn 32, N. Y.

Tuohy Named LILCO Chief Executive Officer

John J. Tuohy, president of Long Island Lighting Co, has been designated chief executive officer. Errol W. Doebler, who held that post, continues as chairman of the board.

Fred C. Eggerstedt Jr has been elected a vice president of the company.

Tuohy joined Long Island Lighting in 1945, and was made assistant to the president in 1950. In 1954 he was elected vice president in charge of sales, promotion, publicity and employee relations. He was elected president and a director on Nov. 1, 1957.

Eggerstedt has been with LILCO since 1950, being named assistant treasurer in 1951 and assistant vice president in 1955.

Doebler joined the utility in 1927, was appointed president and chief executive in 1953, and chairman of the board of directors in 1957. He has been a director since 1945.

TUOHY EGGERSTEDT

Indianapolis P&L Makes Switzer a Vice President

George F. Switzer has been elected vice president in charge of engineering and construction of Indianapolis Power & Light Co. He succeeds Dan C. Hess who has retired but will continue as a consultant for the company.

Switzer joined the company in 1932 following his graduation from Purdue University. Advancing through various supervisory positions he was made chief engineer in 1950. In 1957 he was elected assistant to the vice president, and assistant vice president in 1958.

Hess was general manager of the municipal electric system in Richmond, Ind., for 16 years prior to joining Indianapolis Power & Light. He was elected a vice president in 1939.

Hoffman Named VP-Purchasing at Brewer-Titchener

Brewer-Titchener Corp has appointed A. Willard Hoffman as vice president for purchasing. He moves up from the post of director of purchases.

Hoffman has been associated with Brewer-Titchener for over 40 years, having started his career with the company's Crandal-Stone Division in Binghamton, N. Y., in accounting and production planning.

He is a former national director of the National Assn of Purchasing Agents, and a past president of the Central New York Purchasing Agents.

(*More News About People on page* 94)

Dunham Made Manager of Utility Sales

Austin W. Dunham has been named manager of utility sales at Anaconda Wire & Cable Co.

He joined Anaconda in 1932 and, after a series of headquarters assignments, was transferred to the Denver territory in 1938. After becoming district manager of the Denver sales office, he later served as district manager in Detroit and Cleveland.

A past president of the Electrical Assn of Detroit, he was elected president of the Electrical Manufacturers Assn of Michigan for the 1959-60 term.

PERSONAL BRIEFS

Southern Indiana Gas & Electric Co has elected **George R. Woehler,** vice president and comptroller, to the board of directors.

Potomac Edison Co has elected **Martin J. Urner,** assistant vice president, **L. Arden Kolkhorst** has been made service specialist, and **Homer L. Micheal,** service manager of the Keyser District.

Middle West Service Co has opened an office at 1725 K Street, NW, Washington, D.C. **Harold E. Marmaros** has been appointed resident manager.

Ebasco Services Inc has appointed the following: **Robert W. Self,** insurance consultant; **Robert P. Breckenridge,** senior marketing consultant; **Robert M. Ramey,** director of industrial relations services; and **Larry J. Aubrecht,** director of management consulting services on the western region staff.

Harold H. Young, general partner of Eastman Dillon, Union Securities & Co, has retired, but will continue as a public utilities consultant to the firm. Management of the public utilities department will be under the direction of **Donald S. MacFadden.**

T. Gordon Willows has been appointed construction manager of Hydro-Electric Power Commission of Ontario's St. Lawrence Power Project at Cornwall.

Florida Power Corp has elevated the following to the board of directors: Senior Vice Presidents **J. Shirley Gracy** and **H. K. McKean. R. N. Robertson** has been promoted to director of the residential development, replacing **C. W. Ailstock** who has retired. In other promotions **D. Frank Shiphorst** has been named superintendent of transportation for Florida Power Corp. **S. Z. Douglas** has been promoted to superintendent of the company's Higgins plant, succeeding **Roy Marr** who retired recently. **George W. Dowsett** was named assistant manager of the real estate and tax department. **James L. Shoemaker** has been promoted to director of market research.

California Electric Power Co has appointed **J. G. Hart,** assistant chief engineer.

Carl D. Reese, vice president of the Northern Indiana Public Service Co, elected president of the Indiana Electric Association. **R. E. Doyle Jr,** vice president and general manager of the Indiana & Michigan Electric Co, named vice president.

Florida Power & Light Co has made **Fred Davis** plant superintendent of the Lauderdale Plant; **George Liebler,** plant superintendent of the Everglades Plant; and **J. W. Williams Jr,** superintendent of the Palatka Plant.

P. R. Mallory & Co has combined two of its manufacturing divisions and three subsidiaries in a Metallurgical and Mechanical Group. **Leon Linn** has been appointed manager of the new group. The Metallurgical and Mechanical Group consists of the Mallory Metallurgical Co, Electronic Timers Co, Philadelphia Bronze & Brass Corp, S-M-S Corp, and Indar Corp.

J. Albert Bertolacci has been promoted to treasurer of Cornell-Dubilier Electric Corp.

Charles D. Scribner has been named vice president in charge of personnel for the Remington Rand Division of Sperry Rand Corp.

Simplex Wire & Cable Co has appointed **Marshall A. Williams,** director of marketing.

W. J. Clark has been named sales manager for Jasper Blackburn Corp.

Heyl & Patterson, Inc, has made **H. R. Edelman** executive vice president; **J. F. Page,** vice president, assistant to the president and treasurer; and **Charles F. McKenna,** secretary.

Julius R. Pascuzzo made vice president of the Curtiss-Wright Corp.

James F. Zboyovsky has been appointed manager of the Thomas Works, Delta Star-Electric Division, H. K. Porter Company Inc.

Minneapolis-Honeywell Regulator Co has appointed **James W. Hughes,** sales manager of the Valve Division, and **C. D. McIntire,** industrial manager in the Midwest region. Vice President **Henry F. Dever** transfers to the company headquarters in Minneapolis.

Terry P. Cunningham has been appointed director of advertising production, and **Edward L. Slater,** di-

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To the man on the route slip...

...the $6 you save —Is it worth it?

- Stacks of dog-eared copies piling up on your desk...
- The chore of trying to carve out time to read in the midst of office pressures...
- The risk of missing something important you should know about today...

The coupon below will bring you 52 weekly issues of Electrical World directly to your home. You can pay the $6 later.

Send 52 issues of Electrical World to:

Name_____
Address_____ House ☐ Business ☐
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Title_____
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HA-3

rector of advertising for Sylvania Electric Products, Inc. **Walter K. Anderson** has been named manager of equipment development, replacing **Roland M. Gardner** who has retired.

Koppers Co, Inc, Wood Preserving Division, has named **Donald F. Over,** manager of advertising and public relations, and **David E. Birkhimer,** assistant manager.

Stone & Webster Engineering Corp has made **George W. Letteney** assistant treasurer.

Graybar Electric Co, Inc, has appointed **Edwin Lex Bacon,** general advertising and sales promotion manager; **Raymond C. Babcock,** advertising manager; **Ralph Sackett Jr,** sales promotion manager; and **W. B. Whaley,** assistant treasurer.

Keasbey & Mattison Co has appointed **John F. Heaney,** sales supervisor at the Perth Amboy plant.

Daniel M. Lundvall has been appointed manager of quality control and customer service at Kellogg Switchboard & Supply Co.

Clifford E. Oman has been named assistant to the director of production, and **James R. Smith** assumes full responsibility for Tuscola, Ill., plant operations at U.S. Industrial Chemicals Co.

H. K. Porter Company, Inc, has appointed **Charles R. Billman,** general manager of the National Electric Division.

William Maish has been made director of marketing at Diamond Expansion Bolt Co.

OBITUARY

Davis M. DeBard, 75, consultant to Reddy Kilowatt Inc, and former vice president of Stone & Webster Service Corp . . . **Ephraim H. Brown,** secretary and director of Ohio Brass Co . . . **Edward B. Myers,** 77, retired manager of divisions; **Walter G. Filson,** 78, retired stationary engineer, both of Philadelphia Electric Co . . . **William B. Garnett,** 64, assistant secretary, Kentucky Power Co.

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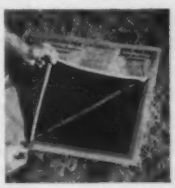
POL-NU PAK

Convenient, envelope-type ground-line treatment bandage

Now line crews can apply ground-line preservative treatments to poles when they do overhead work by carrying Chapman Pol-Nu Paks on service trucks as standard equipment. This convenient pole preservative bandage, available in several sizes, comes as a completely sealed envelope which is easily opened and wrapped around the pole. Chapman Pol-Nu, grease-type pentachlorophenol compound inside the bandage, protects the critical ground-line area from decay and insures longer pole life. Mail the coupon for complete information on Pol-Nu Paks and on Pol-Nu in bulk for use with the Pol-Nu Bandage-Maker when many poles are to be treated.



Slit Pol-Nu Pak on three sides and open to expose the preservative.

Wrap the bandage around pole at ground-line and back-fill.

CHAPMAN CHEMICAL COMPANY
Leading manufacturer of wood preservatives
Memphis 1, Tenn.
Palo Alto, Cal. • Portland, Ore. • Minneapolis
Charlotte, N. C.

Mail coupon for complete data
Chapman Chemical Company
P. O. Box 138, Memphis 1, Tenn.
Please send data on Pol-Nu Pak and information on extending pole life to:
Name_____
Company_____
Address_____

CEI Stages A Clinic on 'Tailored Trees'

Utility's master tree plan seeks to place attractive trees where they will not interfere with distribution lines

KWANZAN CHERRY TREE is planted by two clinic registrants. CEI consulting arborist E. H. Scanlon, looks on

A tree may be a thing of beauty, but to utilitymen it isn't always a a joy forever. To them, a tree is an object which tends to interfere with overhead lines or fall and causes outages.

In a move to alleviate the situation, Cleveland Electric Illuminating Co held a tree clinic in conjunction with its long-range master tree plan which it has been developing for five years.

The aim of the plan, a free CEI service to the communities in its service area, is proper selection and placing of trees where they will not interfere with distribution lines.

Any community in CEI's service area which requests its help in tree planning and planting will receive the services of CEI's consulting arborist, Edward H. Scanlon, who will devise a master plan tailored to the community and its special requirements. Under the program's auspices, 15,000 trees have been planted in approximately 40 communities.

Arborist's Services Free

Since many of the 138 communities in CEI's four-county service area do not employ full-time arborists, the service provides them with the training and experience of CEI's own staff on a free basis.

CEI regards its master tree planning service as an extension of the service it provides its customers. However, the benefits work both ways: if the communities CEI serves adopt special plans for beautiful—yet practical—trees, the utility saves time and money by no longer having to contend with outages caused by fallen trees, broken branches or with clogged sewers, uprooted curbs and sidewalks, and obstruction of street and traffic lights.

The 110 city officials, arborists and planners from the Cleveland-Northeast Ohio area who attended CEI's day-long tree clinic conference learned from speakers how to achieve aesthetic and economic effects in planting trees.

Second Conference Planned

Scanlon, who is a former Cleveland shade tree commissioner, discussed new trees. Other speakers talked on why a community should have a planned tree program, organization for a limited new tree maintenance program, and pruning trees up to five years old.

Plans are underway for a second conference.

EXHIBIT VIEWERS see how 'tailored trees' fulfill community desires and CEI needs. List is displayed of 138 communities taking part in CEI master tree plan

NEW SPRAGUE MODEL 500 INTERFERENCE LOCATOR

PORTABLE, VERSATILE UNIT PINPOINTS SOURCE OF INTERFERENCE

This improved instrument is a compact, rugged and highly sensitive interference locator—*with the widest frequency range of any* standard available unit.

New improvements in Model 500 include: *greatly increased sensitivity*, meter indications proportional to carrier strength, transistorized power supply. Engineered and designed for practical, easy-to-operate field use, it is the ideal instrument for rapid pinpointing of interference sources by electric utility linemen and industrial trouble shooters. Model 500 tunes across the entire standard and FM broadcast, shortwave, and VHF-TV spectrums from 540 Kc to 216 Mc. For full details send for brochure IL-102.

SPRAGUE ELECTRIC COMPANY
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THE MARK OF RELIABILITY

Navajos Block APS Line To Serve Hopi Villages

Navajo Indians who perpetuate a centuries-old feud with Hopi Indians in Arizona are blocking an Arizona Public Service attempt to run a transmission line to the Hopi, whose reservation is surrounded by Navajo.

The Navajo dream of entering the public utility business, themselves.

Hopi chieftains granted Public Service a franchise to serve its villages—including Orabi, claimed to be the oldest continuously inhabited town in North America. The Navajo won't grant permission for a transmission route.

In the past the Navajo have taunted the Hopi often, including running a sewage disposal line to the reservation border—where it is a problem for neighboring Hopi towns.

Looking ahead to the time when it might want to get into the power business, the Navajo Tribal Council explained it would grant Public Service a right-of-way to the Hopi land only if the company agreed to sell its lines to the Navajo when and if the tribe decided it wanted to buy them.

More Tests Scheduled On 450 Mw Generator

The date of first commercial operation of Indiana & Michigan Electric Co's new Breed Plant in Sullivan County, Indiana has been moved back from June to September to permit more extensive testing of the boiler installation, according to American Electric Power Co. officials.

The Breed Plant houses a single 450 Mw generator unit which will be the World's largest at the time that it goes into service. A sister unit of the same size is being built by Ohio Power Co at the Philip Sporn Plant in West Virginia.

Extensive testing of the 450 Mw unit has been under way for the past several months. A recent decision to perform additional testing on the boiler has made it necessary to move back the initial operating date to September, it was stated.

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1. QUALITY is important. When you invest in a fence you want it to last for a long, long time. When you specify PAGE you get 77 years of our experience in the design and manufacture of a quality fence. Page Fence is engineered for long-lasting service and is covered by a Registered Certificate of Quality.

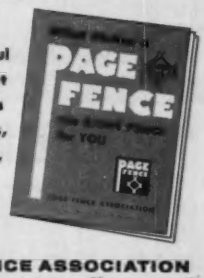
2. WIDE CHOICE is important. For example, we offer a choice of 4 chain link fabrics—ACCO-Aluminized, our latest development, or galvanized steel, stainless, or solid aluminum. Each of these has characteristics which meet individual preferences or make it more suitable to meet certain climatic or service conditions. Furthermore, there are 8 basic fence designs and 6 gate styles. No other company can serve you with so wide a selection.

3. INSTALLATION is important, too. A fence can be no better than the quality of its erection. The Page Fence Member in your locality is trained, experienced, responsible, and interested in your satisfaction.

• • •

When you write us, we'll send you the whole story in a helpful booklet, and the name of our nearest Member. Call him, he will gladly suggest the best answer to your property protection problem.

Helpful booklet describes fence styles, gates and, components



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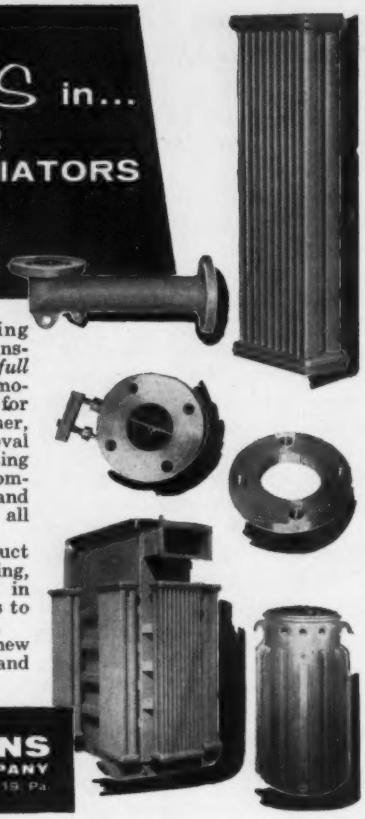

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Oregon Governor Favors High Mountain Sheep Dam

Oregon's Governor Mark Hatfield has gone on record in a letter to the Federal Power Commission favoring Pacific Northwest Power Co's proposed High Mountain Sheep project and opposing the Nez Perce project sought by Washington Public Power Supply.

Concurring with the Oregon Water Resources Board recommendation that High Mountain Sheep be licensed, Hatfield wrote that Nez Perce would block 43% of salmon passing McNary Dam.

"We cannot countenance development of our water resources, or any other resource for that matter, to the exclusion of another resource," Hatfield wrote.

Washington Utilities in Relocation Court Test

A test suit filed in King County Superior Court against the Puget Sound Power & Light Co and two other utilities challenges constitutionality of a 1959 state law requiring the state to reimburse utilities for relocating facilities in the path of interstate highway projects.

Also involved are Pacific Telephone & Telegraph Co and King County Water District No. 75. Construction of an interchange for a new freeway requires relocation of utility facilities along Highway 5-A south of Seattle.

The litigation is intended to answer the question of cost liability for relocations subsequent to last June 30, the cutoff date established in the 1959 law. Costs occurring prior to that date in connection with interstate projects must be borne by the utility, the state supreme court ruled recently.

A principal ground for challenging the new law is an earlier law which requires that proceeds from the state motor vehicle fund be spent only for "highway purposes," said John J. O'Connell, state attorney general. The court will be asked to rule whether utility relocations fall into that category.

The three utilities have agreed to proceed with the relocation, pending the test action.

European Atom Plans Cut Back

Vienna—*McGraw-Hill World News*—Reports are multiplying that European nuclear power development is slowing down because of high costs.

Poland's *Trybuna Rabotnicza*, a daily newspaper, says that Russia has slashed its nuclear power plant program in half. At about the same time, the European Atomic Energy Community (Euratom), in its annual report, states:

"The cost of nuclear electricity is much higher than that of electricity produced by conventional thermo or hydroelectric power plants."

In the report, too, is the statement:

"Manufacturers and electricity producers must be ready to make certain temporary sacrifices and to commit themselves resolutely to carrying a minimum nuclear power plant program."

Cost was the reason reported for the Russian cutback, too. Use of oil and natural gas has reduced the cost of power to a low level that nuclear power cannot compete with.

Not given is the amount of nuclear power now being generated in Russia. The report is substantiated somewhat by recent announcements of major developments of thermal and hydro projects underway or planned by the USSR.

Euratom, an agency of Belgium, France, The Netherlands, Italy, Luxembourg and West Germany, has only one of five proposed nuclear stations under construction. All were originally expected to be completed in 1963.

Poland's nuclear power plant program has been shelved, too, and those of Czechoslovakia, East Germany and Bulgaria have been slowed down. Here is what is reported for the four countries:

- Poland's Sejm (Parliament) Committee on Heavy Industry diverted part of the investment planned for its first nuclear power plant to a research fund and stopped the power plant activity.
- Czechoslovakia has slowed work on its first plant which was intended to go on the line in late 1960. Material deliveries are only in the earliest stages.
- East Germany's prototype and training power plant, planned for completion this year, is believed to be far from operative.
- Bulgaria, in mid-March, postponed actual construction of a nuclear power plant until after 1970.

New AIEE District Formed in Southwest

American Institute of Electrical Engineers has formed a new district (15th) by splitting the Seventh or South West District. The other half of the old district will be known as the Mid-America District, and includes the states of Kansas, Missouri, Oklahoma, and Arkansas.

I. T. Monseth of St. Louis, formerly vice president representing the South West District, will head up the new one. P. G. Wallace has been nominated to be vice president representing the South West District, which is composed of New Mexico, Texas, and part of Louisiana.

LETTERS

(*Continued from page* 5)

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(2) The diggers powered directly by gasoline engines generally do not have exposed drive belts or pulley wheels. These are mounted inside a housing which covers the engine as well.

(3) Practically all portable diggers of recent manufacture are kept from rotating by a telescoping arm or shaft (torque bar) that is attached to the body or frame of the truck.

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DEPARTMENT OF THE INTERIOR, Bureau of Reclamation. Sealed bids (Invitation No. DS-5327) will be received at Denver, Colorado, until 2 p.m., Mountain Standard Time, June 9, 1960, for furnishing twenty-five, 230-kv, 1,200-ampere, 3-pole, manually-gang-operated and five, 69-kv, 600-ampere, 3-pole, manually-gang-operated air switches for Fort Thompson Substation, Missouri River Basin Project, South Dakota. Delivery is desired within 220 days. For particulars, address Bureau of Reclamation, Building 53, Denver Federal Center, Denver 25, Colorado. Floyd E. Dominy, Commissioner.

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The Meetings Calendar

MAY

• **Wisconsin Utilities Association**—Accounting Section Conference, Lake Lawn Lodge, Delavan, May 15-17.

American Institute of Electrical Engineers—Appliance Technical Meeting, Leland Hotel, Mansfield, Ohio, May 16-17; Electrical Problems in the Cement Industry, Pfister Hotel, Milwaukee, May 17-19.

Illuminating Engineering Society—Great Lakes Regional Conference, Carter Hotel, Cleveland, May 16-17.

Pennsylvania Electric Association—Joint Structures & Hydraulics & Prime Movers Committees, Dimeling Hotel, Clearfield, May 16-17; Relay Committee, Fort Stanwix Hotel, Johnstown, May 19-20; Transmission & Distribution Committees, Berkshire Hotel, Reading, May 19-20.

Edison Electric Institute—Electrical System and Equipment Committee, Baker Hotel, Dallas, May 16-17; Meter & Service Committee, Hotel Lorraine, Madison, Wis., May 22-25.

• **Pacific Coast Electric Association** — Annual Meeting, Las Vegas, May 16-18.

• **National Safety Council**—Public Utilities Section, Executive Committee, Sheraton-Fontennelle Hotel, Omaha, May 17-18.

• **American Society of Mechanical Engineers**—Production Engineering Conference, Schroeder Hotel, Milwaukee, May 17-19; Oil & Gas Power Conference & Exhibit, Muehlebach Hotel, Kansas City, Mo., May 22-26; Design Engineering Conference & Show, Statler Hilton Hotel, New York City, May 23-26.

• **Michigan Municipal Utilities Association**—Spring Conference, Pick-Fort Shelby Hotel, Detroit, May 19-20.

• **Northwest Public Power Association**—Engineering & Operations Section, Annual Meeting, Elks Lodge, Port Angeles, Wash., May 19-20.

• **Air Pollution Control Association**—Fifty-third Annual Meeting, Hotel Netherland-Hilton, Cincinnati, May 22-26.

• **Instrument Society of America**—Ninth National Telemetering Conference, Miramar Hotel, Santa Monica, California, May 23-25.

• **Northwest Electric Light & Power Association**—Business Development Section, Chinook Hotel, Yakima, Wash., May 23-25.

• **Rural Electric Generating Cooperatives**—Eleventh Annual Conference, Stoddard Hotel, La Crosse, Wis., May 23-26.

• **Electric Companies Advertising Program**—PIP Mid-Atlantic Region, Rochester Gas & Electric Corp's Employee Center, Rochester, May 24.

JUNE

• **Pennsylvania Electric Association** — Meter Committee, Hazleton, June 2-3.

• **Southeastern Electric Exchange**—Industrial Power Sales Conference, Battery Park Hotel, Asheville, North Carolina, June 2-3.

• **Electric Companies Public Information Program**—PIP Steering Committee, Atlantic City, June 5.

• **American Society of Mechanical Engineers**—Semi-Annual Meeting & Aviation Conference, Statler Hilton Hotel, Dallas, June 5-10; Applied Mechanics Conference, Pennsylvania State University, University Park, June 20-22.

• **Edison Electric Institute**—Annual Meeting, Atlantic City, June 6-8.

• **Illuminating Engineering Society**—Northeastern Regional Conference, Westworth-By-the-Sea Hotel, Portsmouth, N. H., June 8-9; Canadian Regional Conference, Nova Scotian Hotel, Halifax, Canada, June 13-14.

• **National Society of Professional Engineers**—Annual Meeting, Statler Hotel, Boston, June 8-11.

• **American Nuclear Society**—Annual Meeting, Palmer House, Chicago, June 12-15.

• **American Society of Heating Refrigerating & Air Conditioning Engineers**—Annual Meeting, Vancouver, B. C., Canada, June 13-15.

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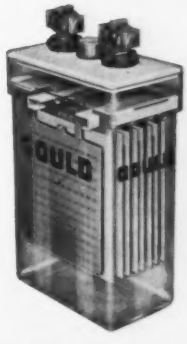

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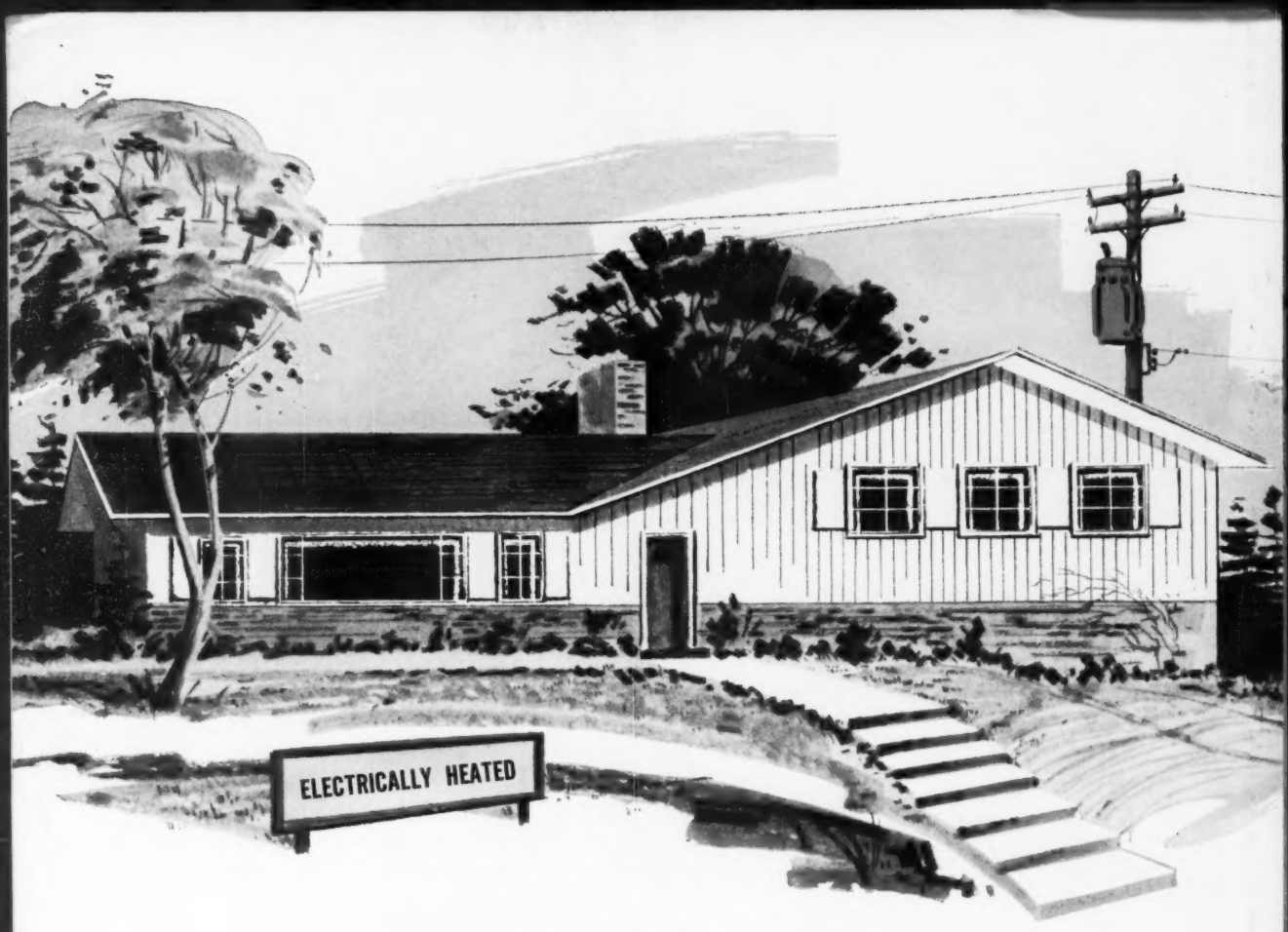

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